The implications of climate change for glacier recreation and tourism at Aoraki/Mount Cook National Park, New Zealand

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Jessica Hughes Hutton

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Abstract of a thesis submitted in partial fulfilment of the requirements for the Degree of Master of Applied Science.

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Aoraki/Mount Cook National Park is an iconic alpine destination in New Zealand, attracting thousands of visitors annually with its wide array of recreational opportunities. In recent years, however, the many glaciers within the Park have been experiencing increasingly rapid recession. The implications of glacial recession for tourism and recreation, as well as the perspectives held by various stakeholders, has been relatively unexplored.

A mixed-method approach was adopted to investigate the glacier experience from the perspectives of visitors, tourism operators and park managers, and an assessment of the effects of climate-induced changes on recreation and toursim was undertaken. Perceptions of glacier-related climate change significance and level of awareness were investigated through visitor surveys (*n*=400) and key informant interviews (*n*=12) in order to better understand the impacts on visitor experiences.

Results revealed that the importance of viewing the glaciers was not a major motive for people visiting the Park, however the level of awareness around climate change and glacial recession suggests there is potential for a 'last-chance tourism' dimension to emerge. Furthermore, the findings demonstrate a high capacity for adaptation among key informants under current changing climatic conditions. These results are discussed in light of the implications for tourism operators and protected area managers.

Keywords: Climate change, glacier tourism, glacier recreation, last-chance tourism, adpative capacity, protected area management, Aoraki/Mount Cook National Park, New Zealand

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Chapter 1

Introduction

1.1 Overview

Amplified concentrations of greenhouse gases in the atmosphere have led to climatic changes worldwide (IPCC, 2013; Wratt & Mullan, 2016). This has resulted in many regions suffering from significant physical and biological impacts such as sea level rise, droughts, floods, glacial recession, species extinctions, natural disturbances and extreme weather events (Becken & Hay, 2007; IPCC, 2013). As well as these effects, climate change has also had substantial socio-economic impacts on the tourism and recreation industry, influencing the management of infrastructure, health and safety and visitor experience (De Freitas, 2005; Scott, Hall & Stefan, 2012).

In recent years, climate scientists have agreed that the change in global mean temperature caused by greenhouse gas emissions is irreversible (Gillet, Arora, Zickfeld, Marshall & Merryfield, 2011), meaning that the climate will continue to be modified into the future even if emissions are significantly reduced (IPCC, 2013). It is not surprising, therefore, that climate change has become a key environmental concern for conservation agencies responsible for managing protected areas (Brace & Geoghegan, 2010; Wilson, Espiner, Stewart & Purdie, 2014).

Protected natural areas are established in order to maintain the natural and cultural heritage within a specified setting, as well as to conserve rare or threatened physical aspects of the area (Lemieux, Beechey & Gray, 2011). It is claimed, therefore, that protected areas are particularly sensitive to climate change and its associated impacts (Stewart, Wilson, Espiner,

Purdie, Lemieux & Dawson, 2016), resulting in significant challenges for park managers required to balance conservation and visitor experience (Wilson et al., 2014).

Mountainous regions have a long history as important attractions for people all over the world (Nepal, 2011). Glaciers, as key features of these areas, are described as large supplies of water which gain mass by the input of snow and ice collecting on their surfaces (Purdie, 2013). In simple terms, a glacier is the surplus ice that gathers above the permanent snowline where the losses to summer melting are less than the gains of winter accumulation. Salinger, Chinn, Willsman & Fitzharris (2008) state that the higher the mountain rises above the permanent snowline, the more excess snow is able to accumulate, and therefore the bigger the glacier formed. Processes such as melting and carving have the ability to severely diminish glacier ice, largely due to continuous fluctuations in temperature and snowfall (Hay & Elliot, 2008). Glaciers also experience a decrease in mass as a result of melting and calving (Benn & Evans, 2010). Being extremely dynamic in nature, 'glacier tourism' has emerged as a way for people to undertake activities on glaciers such as hiking, climbing, skiing and flying over or onto them (Hay and Elliot, 2008; Nepal, 2011; Stewart et al., 2016). Glacier tourism has been described as a combination of adventure and nature-based tourism aimed at tourists in search of challenging experiences in unique settings (Furunes & Mykletun, 2012). Similarly, although not specifically defined in the literature, glacier recreation involves activities akin to those of glacier tourism, although these are likely to be undertaken in more remote, backcountry areas of alpine settings.

Recent evidence shows that glacial recession and decreased snow cover are consistent trends emerging in most of the world's glaciated regions (IPCC, 2013), clearly highlighting just how vulnerable these alpine landscapes are to climate change (Purdie, 2013). In fact, according to

Hay and Elliot (2008), glaciated regions *"play a critical role in our understanding of global and regional climate variation" (p. 194),* and have therefore been regarded as key indicators of climate change for many years (McDowell, Stephenson & Ford, 2014; Stewart et al., 2016). It has also been argued that dramatic changes to mountain climates have the ability to modify seasonal patterns in tourism and recreation (Nepal, 2011).

New Zealand is home to thousands of glaciers, with the well-known Tasman, Fox and Franz Josef being three of the most accessible glaciers in the world (Chinn, 1999; Stewart et al., 2016). It is not surprising, therefore, that these glaciers have been heavily utilised by a range of tourism and recreation operations. Aoraki/Mount Cook National Park, in particular, has approximately 178 glaciers within its boundaries, all of which have already witnessed rapid ice loss common in most mountainous areas around the world (Purdie, 2013). Given that a large percentage of New Zealand's protected areas are responsible for conserving rare or threatened natural and geographical resources (Lemieux et al., 2011), as well as the scale at which climate change is occurring, it is expected that park managers and operators will witness significant shifts in visitor behaviour, including changing visitor demand and destination preferences (Stewart et al., 2016). While it can be said that not all aspects of climate change have a negative impact on tourism, these changes are generally investigated within the broader field of 'last chance tourism' (Wilson et al., 2014). While a range of terms have been used to describe this phenomenon, definitions consistently highlight the desire for observing and interacting with threatened or rare species or physical features (Dawson, Johnston, Stewart, Lemieux, Lemelin, Maher & Grimwood, 2011). According to Lemieux and Eagles (2011), many last chance tourism attractions are located within protected areas.

As well as being a national park with extraordinary cultural significance (Thompson-Carr, 2012), Aoraki/Mount Cook has a long-standing history with outdoor recreation, particularly among mountaineers and other backcountry users (Wilson, Stewart, Espiner & Purdie, 2015). Mount Cook was first climbed by Tom Fyfe, Jack Clarke and George Graham, on Christmas Day, 1894. On the 3rd December, 1910, Emmeline Freda Du Faur became the first woman to climb Mount Cook. Her attempt was also the fastest ascent at the time (Stewart et al., 1998). Additionally, with more than half a million international tourists expected to visit Aoraki/Mount Cook National Park in the next year (Cavanagh, 2016), it is now both critical and timely to investigate the ways in which bio-physical changes to the glaciers at Aoraki/Mount Cook National Park could potentially affect visitor access and perceptions of scenic amenity, as well as how climate change will impact management decisions and policies relating to conservation and visitor use in the Park.

1.2 Research objectives

The overarching aim of this study was to investigate the implications of climate change for glacier recreation and tourism at Aoraki/Mount Cook National Park. Therefore, a key focus was to explore the ways in which identified stakeholders perceive and interpret change in the Park by concentrating on the following five objectives:

1) Understanding the nature of recreation and tourism

2) Outlining the current glacier visitor experience

3) Investigating the implications of climate change on the glacier visitor experience

4) Exploring the perceptions of climate change among visitors and key informants and the level of awareness around the impacts this may have on resources bound in the Park

5) Examining the extent to which the various stakeholders are responding and adapting to change

In order to address these objectives, a mixed-methods approach was undertaken via a quantitative researcher-administered survey of visitors to the Park, as well qualitative interviews with park managers and operators.

1.3 Research contribution

This study set out to address key research gaps within the emerging field of glacier recreation and tourism, particularly in response to the need for categorising the existing or potential impacts that climate change may have on the tourism industry, as well as the need for identifying adaptation strategies implemented by operators, managers and visitors (Welling, Árnason & Ólafsdottír, 2015). As Becken and Hay (2007) point out, there is a growing literature investigating the ways in which destinations may adapt to the changing climate, however McDowell et al. (2014) and Welling et al. (2015) emphasise that there is currently very little understanding around adaptation and how bio-physical changes to glaciers will impact the behaviour of visitors, as well as the associated implications for management strategies and visitor use policies. Conversely, there has been very little research conducted on the impact of climate change on outdoor recreation other than a few studies which have focused on the skiing industry and the challenges faced by ski resort managers (Elsasser & Bürki, 2003; Scott, McBoyle & Mills, 2003).

Equally, Lemieux et al. (2011) claim that last-chance tourism researchers have yet to solely focus on tourism experiences in glaciated alpine regions within the context of protected area management. Therefore, in order to address this knowledge gap around the potential

behavioural responses of visitors in light of the Park's increasingly rapid glacial recession, this study explored the experiences of tourists and recreationists, as well as the perspectives of the various key informants responsible for the conservation and management of the Park. This investigation is particularly timely given that the Park's current Management Plan (2004) is under review.

1.4 Thesis structure

This thesis is organised into seven chapters. Chapter 2 presents a review of the relevant literature and identifies key research gaps, with a focus on the impacts of climate change for glacier recreation and tourism, last chance tourism and adaptive capacity. Chapter 3 introduces Aoraki/Mount Cook National Park as the case setting for the study and provides context for the objectives of this research. Chapter 4 discusses the mixed-methods approach adopted for the study and describes the data collection, analyses and limitations.

Chapters 5 and 6 present the results of the research by integrating both the quantitative and qualitative data. Chapter 5 concentrates on the first two research objectives (the nature of recreation and tourism and the current glacier visitor experience), while Chapter 6 focuses on the remaining three objectives (the implications of climate change on the overall experience of glacier visitors; the perceptions and level of awareness among visitors and key informants; and the extent to which they have responded and adapted to changes in the Park). Chapter 7 discusses the key findings of the research in light of the existing literature and provides a conclusion to the thesis, including areas for future research.

Chapter 2

Literature Review

This chapter reviews literature associated with the implications of climate change for glacier recreation and tourism with the aim of providing the research context for this study. The first section focuses on the relationship between climate change, tourism and outdoor recreation on a large scale. The second section then concentrates more specifically on the literature aligning with the aims of the current study by investigating the impacts of climate change in alpine environments, the emergence of glacier tourism in light of the changing environment, and the current vulnerability of glaciers in New Zealand. The chapter concludes with a summary, highlighting the key gaps in the existing literature and thus emphasising the relevance of the current research.

2.1 Climate change, tourism and outdoor recreation

The most recent Assessment Report (AR5) presented by the Intergovernmental Panel on Climate Change (IPCC) in 2013 states that warming of the climate system is evident and climate change is already having a negative effect on the intensity and regularity of many extreme weather and climate events all over the world (IPCC, 2013). It is clear that human activity is having a major influence on the climate system, and it is proposed that further warming and changes to the climate will occur if emissions of greenhouse gases continue at current rates (Scott, de Freitas & Matzarakis, 2009; Wratt & Mullan, 2016). The IPCC (2013) argues that in order for the global population to constrain climate change, significant and constant reductions of greenhouse gas emissions are urgently required. It is claimed that

tourism and outdoor recreation will not be exempt from the impacts of climate change (Becken, 2013; Hall & Higham, 2005; Nicholls, 2006). Among the researchers to address the interrelationships between recreation, tourism and climate change, Higham and Hall (2005) state that 'understanding and responding to climate change represents one of the most important, complex and challenging issues facing the contemporary tourism and recreation industries' (p. 307). According to Nicholls (2006), the lack of attention paid to the potential impacts of climate change on tourism and outdoor recreation is extremely concerning, especially given the proven social and economic values of both sectors worldwide. In a more recent review, Becken (2013) acknowledges that research on tourism and climate change has developed substantially since the first papers were published in 1986, however she argues that it is still under-developed compared to the much broader field of the human dimensions of climate change.

According to Hall (2008), both the tourism and recreation sectors have already witnessed direct and indirect impacts of the fluctuating natural environment on which they so clearly depend. Scott et al. (2003) also argue that weather and climate have a strong influence on the tourism and recreation sector, including the environmental resources that provide the foundation for tourism, such as snow cover for skiing and species habitat for ecotourism. Gössling and Hall (2006) claim that the primary impacts of climate change on tourism include those caused by variations in temperature and precipitation, as well as other climatic variables like snow depth, wind speed and humidity, which all have a direct effect on the experiences and activities of tourists. For example, a warmer climate may improve opportunities for warm-weather activities, such as sightseeing, hiking, camping, mountain biking and hunting, given that it will create more time in which these activities can be

undertaken, especially in the typical 'shoulder seasons' of spring and autumn (Hand & Lawson, 2017). Conversely, however, warmer weather has also seen an increase in wildfires, particularly in North America, which has negatively impacted those same activities (de Groot, Flannigan & Cantin, 2013). Equally, many tropical island destinations centre their tourism product on 'sun, sea and sand', however Becken (2013) states that beach and coastal regions are incredibly sensitive and susceptible to a number of risks presented by climate change. McNutt (2013) claims that these impacts include sea level rise and extreme weather events, resulting in flooding, beach erosion, saline intrusion into aquifers and general coastal degradation. Ocean acidification and warming as a result of climate change have also presented considerable threat to coral reef tourism, whereby increasing temperatures are creating frequent bleaching events that can lead to the loss of both coral cover and reef structure (Spalding & Brown, 2015).

It is the mountain regions, however, that have arguably received the most attention in studies investigating the impacts of climate change. Dawson and Scott (2013) claim that there is a decrease in opportunities for snow-based activities, such as skiing and mountaineering, during the winter months due to a decline in annual snow cover worldwide. Equally, Nepal (2011) argues that the rapid change in mountain conditions brings about the potential for seasonal patterns of tourism to alter dramatically. These are just a few of the many examples highlighting the importance of the natural environment in determining the attractiveness of a region for recreation and tourism (Scott et al., 2003). More specifically, Becken and Hay (2007) claim that these climatic changes have the ability to change the duration, frequency, timing and location of activities for many tourists and recreationists, whereby participants

alter their choice of outdoor activities to account for changes in the natural environment (Amelung, Nicholls & Viner, 2007; Becken, 2013).

It can be said, therefore, that favourable atmospheric conditions and a clean environment are undoubtedly crucial to both the satisfaction of tourists and the success of any tourism destination (Amelung et al., 2007). In fact, Cabrini, Simpson & Scott (2009) argue that outside of tourism and outdoor recreation, there are very few economic activities that are so heavily dependent on the natural environment. Becken and Hay (2007) categorise the ways in which climate has an impact on tourists into three main facets; aesthetic, physical, and thermal. They believe that these aspects contribute to the overall enjoyment, experience and comfort of tourists. However, relatively little is known about the role that climate plays in destination choice (de Freitas, 2005). One such study conducted by Hamilton and Lau (2004) revealed that out of 400 tourists surveyed in Germany, most identified climate as being the most important attribute for any destination. Similarly, the importance of temperature has also been investigated. Bigano, Hamilton, Lau, Tol & Zou (2007) highlighted the importance of temperature in the decision-making process of Italian tourists. According to his study, more tourists travelled abroad, particularly to (cooler) more northern countries, during extremely hot summer months. On the other hand, domestic tourism decreased as a result of warm temperatures in January having a negative impact on the ski season. It is these types of studies that stress the interaction between climate, tourism and outdoor recreation and it is unsurprising, therefore, that Scott et al. (2012) argue that tourism and recreation are unable to escape the effects of climate change.

As a result of the anticipated threats associated with these changes, the industry has witnessed the emergence of ‘last-chance tourism’ (LCT), a type of tourism with the unique

selling point of ‘see it before it is gone’. This phenomenon suggests that increasing numbers of tourists want to experience endangered destinations (or species) before they vanish forever as a result of climate change or other ecological or human-induced issues (Olsen, Koster & Youroukos, 2013), and has been observed in a number of settings worldwide (Lemelin, Dawson, Stewart, Maher & Lueck, 2010). The polar bear viewing industry in Arctic Canada, for example, has frequently been used as a case study for exploring last-chance tourism (Dawson, Stewart, Lemelin & Scott, 2010; Lemelin et al., 2010), including the influence of climate change on the tourism demand of polar bear viewing (Dawson et al., 2011). In their study, Dawson et al. (2010) claimed that last-chance tourism was a motivating factor for tourists who wanted to witness the polar bears of Churchill, Manitoba in their natural habitat before it was no longer possible. Similarly, a survey of people travelling to Antarctica suggested that seeing the region before it is gone was a key motive in their decision to go there (Lamers, Eijgelaar & Amelung, 2012). These papers provide good insight into last-chance tourism in particular locations, as well as the ways in which these trends may apply to other tourism destinations. Burns and Bibbings (2009) argue, however, that there seems to be a large gap in the field of last-chance tourism which includes more nature-based tragedies. Since the publication of their paper, however, the disappearance of glaciers and ski industries have been increasingly explored in light of the rapidly changing climate (Steiger, 2012; Wilson et al., 2014; Kaezing, Rebetez & Serquet, 2015).

The preceding discussion has provided a brief introduction to tourism, outdoor recreation and climate change, and demonstrated that the impacts and effects are very broad. The following sections of this review, therefore, focus primarily on tourism and outdoor recreation in mountainous and glaciated environments. Particularly in New Zealand, these settings account

for a large percentage of tourism and outdoor recreation destinations (Salinger et al., 2008), and hence their consideration provides valuable information for the likely impacts of climate change.

2.1.1 Climate change in alpine environments

The majority of publications on tourism and climate change relate to climate change impacts and adaptation (Becken, 2013). More recently, however, adaptation research has begun to explore the ways in which tourism businesses and other stakeholders can engage in climate change adaptation (Nicholls and Holecek 2008; Turton, Dickson, Hadwen, Joegensen, Pham, Simmons & Wilson, 2010). According to Marshall, Park, Howden, Dowd & Jakku (2013), any sectors considering adaptation as an action of response to current or future climate-related changes need to consider the adaptive capacity of the various stakeholders if any industry-wide response is to occur. They claim that adaptive capacity is the human potential to convert existing resources into successful adaptation strategies. According to McDowell et al. (2014), a broad understanding of the human dimensions of climate change is limited by a shortage of knowledge surrounding the scale and extent to which adaptation is occurring. Conversely, it is argued that insufficient information has been continually identified as a barrier to the planning and implementation of climate change adaptation (Archie, Dilling, Milford & Pampel, 2014). Although this literature suggests that efforts to adapt to climate change have not led to significant rates of adaptation actions (Wise, Fazey, Smith, Park, Eakin, Van Garderen & Campbell, 2014), however, the effects of climate change becoming an increasing concern highlights the need for the tourism and recreation sectors to urgently and realistically adapt

to the changing climate conditions in a range of different landscapes (Michailidou, Vlachokostas & Moussiopoulos, 2016).

As well as being universally recognised for their highly diverse and rich ecosystems, mountain regions are particularly vulnerable to natural disasters and environmental change (Elsasser & Bürki, 2002; Beniston, 2003; Nyaupane & Chhetri, 2009). As a result of being susceptible to temperature fluctuation and extreme precipitation events, it is suggested that any high elevation settings comprising glaciers, water, snow and permafrost are among the most sensitive to climate change on a global scale (Diaz, Grosjean & Graumlich, 2003). Unsurprisingly, Becken (2013) claims that the focus of literature addressing climate change impacts on tourism and recreation in recent years has been on winter sport, with a geographic focus on the European Alps and North America. According to IPCC (2013), mountain ecosystems are likely to experience a future of milder winters, an increase in precipitation and summers that are both warmer and drier. These climatic variations will undoubtedly have a number of consequences, particularly for ski industries (Beniston, 2003; McBoyle & Mills, 2006; Dawson, Scott & McBoyle, 2009), and this has led to a number of European studies examining the projections of decreasing snow depth and cover, and the various implications for ski resort managers (Elsasser & Bürki, 2002; Scott et al., 2003; Hall & Hingham, 2005).

A number of potential adaptation measures have been suggested in order for the ski industry to remain economically viable, not only in Europe, but worldwide (Elsasser & Bürki, 2002). One main technological approach is the implementation of artificial snowmaking capabilities, a strategy in which Scott et al. (2003) believe has been relatively successful in many parts of Canada. This method, however, is expensive to construct and maintain, and also requires huge amounts of water and energy to operate, and is therefore not a likely solution for many

of the smaller ski fields. As well as this, artificial snowmaking requires specific climatic conditions, such as minimum temperatures, in order to function. Under current climate scenarios, this would not be an adequate technique, given that temperatures are expected to continue rising as a result of global warming (Scott et al., 2003). Another key adaptation measure presented by Elssaser and Bürki (2002) is the development of new ski areas at higher elevations. Aside from being a costly development, this method is likely to put increased pressure on previously untouched upper mountain environments, as well as present safety concerns for skiers not accustomed to higher, steeper, and more avalanche-prone slopes. Being the home of many smaller, privately owned club fields, relocating to higher elevations, therefore, does not seem to favour a New Zealand context.

It can be said that any adaptation strategies available to businesses within the mountain-based recreation and tourism industry should be deliberated in light of the likely perceptions and responses of the people who are going to visit the areas. In 1997, Koenig and Abegg conducted a study which revealed that the reaction to estimated climate change differed greatly with the skill level of skiers. Of the experienced participants, for instance, half indicated that they would be prepared to travel to other countries if it meant finding better skiing conditions. Of the less experienced skiers, however, only 18 per cent reported that they would be willing to travel for skiing purposes. In addition, a further 16 per cent of the inexperienced skiers stated that they would stop skiing altogether should the projected changes in climate become a reality. A later study conducted by Bürki, Elsasser, Abegg and Koenig (2005) also discovered that approximately half of the skiers studied would travel in search of new ski areas with more reliable snow conditions if faced with the impacts of climate change, whereas 32 per cent would ski less frequently, and only 4 per cent would discontinue

skiing entirely. Aside from these studies, however, recent research has failed to further address the issue of likely adaptation strategies adopted by participants. In addition, there also appears to be a general lack of exploration into the relationships between climate change and other alpine activities aside from skiing. There is an opportunity, therefore, for new research to investigate the ways in which other forms of tourism and recreation activities have been impacted as a result of changing mountain climates and, more specifically, how various stakeholders have adapted and responded to such changes in glaciated mountain regions.

2.1.2 Climate change and glacier tourism

As a specific sub-component of alpine environments, glaciers offer highly dynamic landscapes for people to experience first-hand (Stewart et al., 2016), however it is only in recent years that researchers have started to investigate tourism in glaciated landscapes (Welling et al., 2015). The emergence of 'glacier tourism' has come about as a result of the combined increase in research exploring nature-based and adventure-tourism (Hall & Boyd, 2005), as well as the relationship between climate change and tourism (Scott et al., 2012). Based on Wang and Jiao's (2012) study, it is only recently that tourism in glaciated areas has been seen as a tourism niche in its own right. They suggest that glacier tourism is conceptualised as a form of nature-based tourism whereby the glacier acts as the primary setting for a variety of outdoor activities. Similarly, Furunes and Mykletun (2012) state that 'glaciers can be considered a playground for tourists seeking different levels of challenges in strange and potentially hazardous environments' (p. 329).

According to Hay and Elliot (2008), glaciers provide ideal settings for people to undertake a range of tourism and recreation activities including walking, climbing, skiing and flying over or onto the ice. Similarly, Welling et al. (2015) claim that glaciers have become popular tourist destinations worldwide, offering a range of outdoor recreation and adventure-based activities including glacier hiking, ice climbing and snowmobiling. Due to this increasing popularity of glaciers as visitor attractions, it is not surprising that researchers have begun to study them in light of the last-chance tourism phenomenon. For example, Beniston (2012) noted that tourists were eager to visit the Rhone Glacier in Switzerland to see the rapidly retreating feature. Similarly, in a more recent comparative study, Stewart, Welling, Espiner and Wilson (2017), investigated the motives of glacier tourists to both Westland *Tai Poutini* National Park in New Zealand and Vatnajokull National Park in Iceland. Findings of the study revealed that people who made trips to the New Zealand glacier region were primarily influenced by the opportunity to witness the glaciers before they potentially disappear forever, whereas this finding was less apparent in Iceland, with visitors being largely motivated by the chance to be close to nature more generally. The authors argued that this result is a reflection on the geographic context of the two case study settings, in which the New Zealand glaciers are the sole major drawcard for visitors as opposed to Iceland, where the glaciers are part of a much broader alpine experience (Stewart et al., 2017).

Responding to the demand for research in this relatively new field of glacier tourism, McDowell et al. (2014) explored the connection between people and glacial landscapes in the context of the human dimensions of climate change. Equally, in response to the call for studies focusing primarily on the difficulties of climate change for glacier tourism, and the suggestion of taking an integrated approach (Smiraglia, Diolaiuti, Pelfini, Beld, Citterio, Camielli &

S'Agata, 2008; Welling et al,. 2015; Purdie, Gomez & Espiner; 2015), Stewart et al. (2016) combined both natural and social science methods in order to make an assessment of climate change at the Franz Josef and Fox Glaciers in Westland *Tai Poutini* National Park. During this study, they investigated the visitor experience in the context of climate change at the Fox and Franz Josef Glaciers on the West Coast of New Zealand. They revealed that although individual aspects of the glaciers did not always match visitor expectations, satisfaction levels with the overall experience were still fairly high. Additionally, it was revealed that there have been a number of adaptive strategies put in place as a result of the rapid glacial recession, including closing the glaciers to foot access and allowing more overflights (Stewart et al., 2016), which is a common finding in the literature on satisfaction with nature-based tourism experiences (Chhetri, Arrowsmith & Jackson, 2004; Moore, Rodger & Taplin, 2015).

During a recent review of glacier tourism, Welling et al. (2015) suggested that studies in the field are limited but growing steadily. They emphasise that, to date, most of the research addressing the relationship between tourism and glaciers provide data from single case studies in a particular context. They believe that although this has advanced the knowledge of glacier tourism, there is variation in how the topic is interpreted, and is therefore lacking in consistency and scope. In addition, Purdie (2013) highlights the need for more in-depth studies on the difficulties that climate change brings to glacier tourism. Equally, there is a need for research on glacier recreation, particularly around the extent to which climate change has impacted activities in backcountry settings, as previous literature has focused primarily on the ski sector (Elsasser & Bürki, 2002; Scott et al., 2003). Finally, there also seems to be significant potential for further research exploring the ways in which protected area visitors, managers and operators have responded and adapted to the changing climate.

2.1.3 Climate change and New Zealand glaciers

Home to more than 3,000 glaciers, many of which are highly accessible, New Zealand has utilised these unique settings for a wide range of tourism and recreation purposes (Purdie, 2013). Unfortunately, however, the country is already experiencing the impacts of climate change, with many regions displaying longstanding trends toward higher temperatures, greater hot extremes, fewer cold extremes, and fluctuating rainfall patterns (Purdie, Mackintosh, Lawson, Anderson, Morgenstern, Chinn & Mayewski, 2011; Hollis, 2014). In a weather and climate-focused study conducted by Becken (2010), respondents were unsure if New Zealand's weather patterns would change in the following years. When the same respondents were asked how desirable a number of climate-related changes might be for tourists visiting New Zealand, however, 'reduction of snow cover and glaciers' had a very low mean score, indicating that respondents did not think that particular change would be desirable for tourists visiting the country. Equally, the reduction of snow cover and glaciers was one of six coded themes that emerged from an open-ended question regarding the most important issues for New Zealand in terms of the impacts associated with climate change (Becken, 2010). According to Wratt and Mullan (2016), it is expected that average temperatures will rise further, resulting in a dramatic decline in peak snow accumulation every year, predominantly in the South Island. This is of particular concern for the mountainous regions of New Zealand, many of which rely heavily on favourable climatic conditions in order to attract tourists and recreationists. Equally, Stewart et al. (2016) predict that the experiences of visitors to these areas will alter as a result of the continued change in mountain climates.

Being of a large scale and highly sensitive to the fluctuating environment, glaciers are one of the strongest indicators of climate change (Purdie, 2013), and have undergone 'drastic' retreat worldwide since the mid-1980s (WGMS, 2008, p.24). Glacial recession is one of the most obvious visual examples of the impacts of climate change, and it is argued that the increase in media attention could be the reason why people have become progressively more interested in these features (Carey, 2007; Gagné et al., 2014). According to annual surveys since 1977, glaciers in New Zealand's Southern Alps have lost more than 10 per cent of their total ice volume (Salinger et al., 2008). It is not surprising, therefore, that the ways in which New Zealand glaciers have responded to climate change have been studied for a number of years.

Salinger et al. (2008) have presented findings that indicate that the instability of glaciers greatly reflect regional climate change and make them effective tools for annual recordings of ever-changing mountain climates. More recently, Willsman et al. (2014) have published results on their annual glacier mass balance surveys, which have measured the altitudes of snowlines on 50 index glaciers along the Southern Alps since 1977. According to their findings, many of the bigger glaciers have been rapidly passing their ice gains down to their termini, causing them to fluctuate massively over the years. For example, length change records for the Franz Josef and Fox Glaciers on the West Coast (Figure 2.1) show that these glaciers are different from many other alpine glaciers previously studied, given that they advanced nearly continuously between 1983 and 2008 as a result of hemispheric ocean-atmosphere variability (Mackintosh, Anderson, Lorrey, Renwick, Frei & Dean, 2017). However, Purdie, Anderson, Chinn, Mackintosh and Lawson (2014) also claim that the present retreat is the fastest in the

records of both glaciers and it is predicted that they will continue to recede at an alarming rate given the projection of further warming during the 21st century (Wratt & Mullan, 2016).

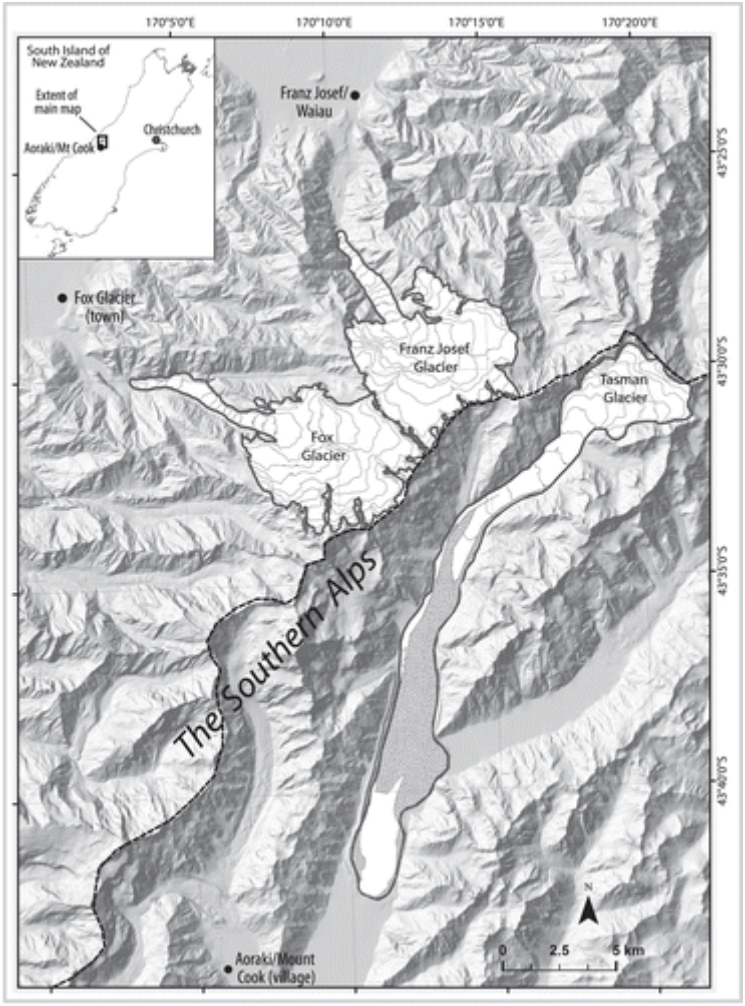


Figure 2.1: Location of the Franz Josef, Fox and Tasman Glaciers in relation to the Southern Alps and the South Island (Source: Purdie, 2013)

Conversely, the Tasman Glacier, the largest glacier in the Southern Alps, has also been the focus of much research over the past few decades. Purdie's et al. (2011) study was highly exploratory, with results indicating that the inter-annual variability of net accumulation on the Tasman Glacier is more subjective to temperature than it is to precipitation. Furthermore,

a study conducted by Quincey and Glasser (2009) revealed that the lake area of Tasman Glacier doubled in size between 2000 and 2007, and provided evidence that lake growth is expected to continue at increasing rates. Although this enlarging proglacial lake has already opened up new tourism opportunities at the Tasman Glacier, the industry of glacier recreation and tourism is still potentially under threat as a result of the ongoing retreat (Figure 2.2). According to Purdie et al. (2015), increased debris cover, steepening ice slopes and an increase in rockfall hazard are just some of the challenges that park planners are having to face as the glaciers continue to recede. Therefore, a study exploring the various implications of climate change for glacier recreation and tourism is required in order to assist operators and managers in their decisions about the future utilisation and accessibility of the glaciers in Aoraki/Mount Cook National Park, the home to approximately 178 separate glaciers and a destination estimated to attract more than half a million visitors in the coming year (M. Davies, personal communication, Sep 15, 2016).

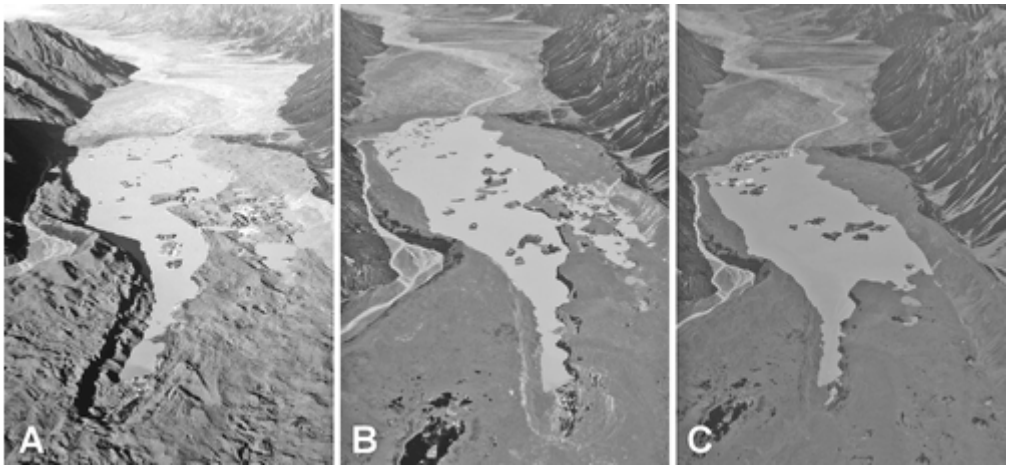


Figure 2.2: Aerial photographs showing the retreat of the lower Tasman Glacier terminus between
A) 2006 B) 2007 C) 2008

(Source: Dykes, Brook, Robertson & Fuller, 2010)

2.2 Chapter summary

Based on the review of literature discussed in this chapter, there lies a gap in the much broader study of how climate change has impacted the overall experiences of the visitors themselves, as well as how visitors and key informants have adapted to such changes. Aoraki/Mount Cook National Park provides an outstanding setting to undertake such research, and would benefit hugely from new findings, especially given that at the heart of glacier tourism is a reliance on a resource that is extremely sensitive to climatic change (Furunes & Mykletun, 2012; Stewart et al., 2016), as described further in the following case setting chapter.

Chapter 3

Research setting – Aoraki/Mount Cook National Park

This chapter presents context and justification for the study's case setting - Aoraki/Mount Cook National Park, and comprises five sections providing insight into the management of the Park, its historical and cultural values, natural and geographical resources and long history with recreation and tourism.

3.1 Historical and cultural values

Since its formal establishment in 1953, Aoraki/Mount Cook has maintained its status of being one of the most remarkable national parks both in New Zealand and worldwide. Situated on the eastern flanks of the Southern Alps, the Park shares a boundary with Westland/*Tai Poutini* National Park for 40 of its 60 kilometre length (Figure 3.1) (Wilson et al., 2015). It is home to New Zealand's highest mountain, Aoraki/Mount Cook (3754 m) as well as 19 other peaks over 3000 m (Stewart et al., 1998; Wilson et al., 2015). After receiving recognition in 1986 for its exceptional natural and cultural values, it was included within the larger Te Waipounamu/South Westland World Heritage Area, only one of three sites in the country (Stewart et al., 1998; DOC, 2004).

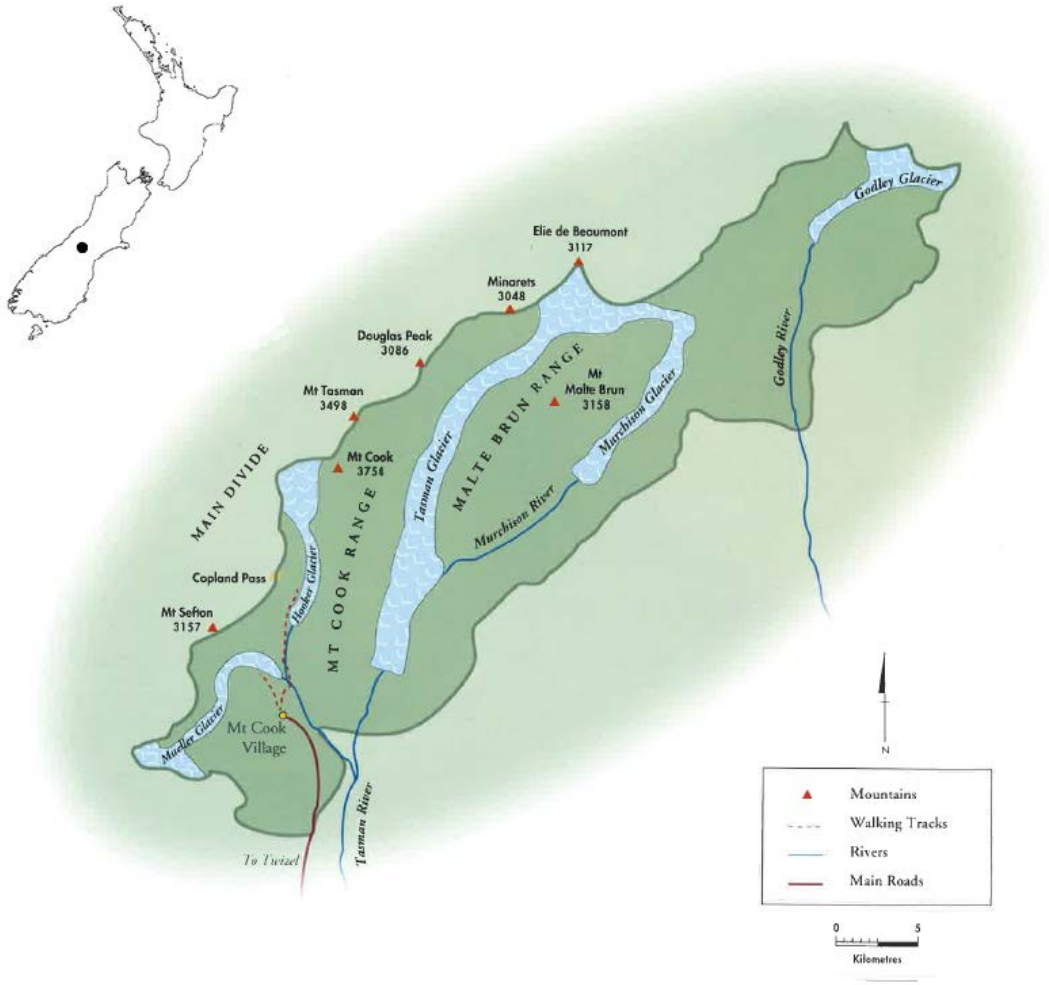


Figure 3.1: Map of Aoraki/Mount Cook National Park
(Source: Potton, 1998)

The Aoraki/Mount Cook village is one of only two communities in New Zealand zoned within national park boundaries, the other being Whakapapa village in Tongariro National Park (Wilson et al., 2015). Under Section 15 of the National Parks Act 1980, the village is an amenities area providing a range of visitor services including food and accommodation, activity operations, a visitor centre and a park management operation centre. The Park's Management Plan (2004) emphasises a requirement for the village to be managed in such a way that does not detract from the Park's World Heritage status. Equally, visitors to the Park are encouraged to view the village as a gateway to the wider landscape, *'a place where visitors*

learn about the Park and its natural and cultural values' rather than as a destination in its own right (DOC, 2004, section 5.1.5).

The Park's natural landscape also holds strong cultural significance for the Maori people of New Zealand, who are renowned for creating solid bonds with the land (Thompson-Carr, 2012). Aoraki/Mount Cook is particularly important to the local Maori iwi (tribe), Ngāi Tahu (Stewart et al., 1998), being an ancestral mountain which provides the iwi with a sense of communal identity. Aoraki (cloud in the sky) is an ancient ancestor who was one of four sons of Rakinui (the sky father), who travelled down to explore Papatuanuku in a canoe known as Te Waka o Aoraki. When they tried to return home, the canoe capsized and turned to stone, forming the South Island. Aoraki and his brothers clambered onto the high side of the canoe and also turned to stone, forming the key peaks of the Southern Alps that are seen today (DOC, 2004). Lake Pukaki's waters are also regarded as having mauri (spirit) as the water enters the lake from Aoraki/Mount Cook via the Tasman and Hooker Glaciers. The water is considered to be sacred and is still used for ceremonial purposes (Thompson-Carr, 2012).

The mountain has been officially recognised as a place that is taonga (a treasure of spiritual significance) for Ngāi Tahu, whose cultural values were acknowledged in the Ngāi Tahu Treaty Settlement Act 1997, when the mountain was officially renamed from Mount Cook to Aoraki/Mount Cook (Thompson-Carr, 2012). A tōpuni (cloak of iwi values) was placed over the mountain to enhance the power and status of Ngāi Tahu and warrant their authority to contribute in management decisions, including a responsibility to protect and sustainably manage the mountain (DOC, 2004). Today, Ngāi Tahu actively strive to encourage respect for their intimate relationship with Aoraki by providing information to climbers and guides, explaining that standing on the very top of the mountain degrades its sacred status (DOC,

2004). Despite there being no members of Ngāi Tahu living permanently in the Park's village, DOC supports Ngāi Tahu in interpreting their traditional relationships and cultural values to visitors (Thompson-Carr, 2012). In addition, Ngāi Tahu is working closely with DOC in the review of the Park's Management Plan in order to maintain the special place that Aoraki holds within the cultural identity of the iwi (DOC, 2004).

3.2 Natural and geographical resources

Aoraki/Mount Cook National Park is a rugged area of ice and rock (Purdie, 2013). Glaciers cover 40 per cent of the Park which is home to five major glacier valley systems, including the Godley, Hooker, Mueller and Murchison, as well as New Zealand's largest, the Tasman Glacier (Purdie et al., 2011). The well-known Tasman Glacier extends 27 kilometres and contains roughly 30 per cent of the country's ice volume (Purdie, 2013; Wilson et al., 2015).

Aoraki/Mount Cook National Park protects a wide range of flora and fauna. There are more than 300 species of plants living within the Park's boundaries, including the Mount Cook lily, *Ranunculus lyalli*, the largest buttercup in the world (Stewart et al., 1998). In addition, there are approximately 40 species of birds found in the Park, including falcons, kea and the only true alpine bird, the rock wren/pīwauwau. One of New Zealand's rarest birds, the kāki/black stilt, lives on the braided riverbed of the Tasman. The Park also supports a number of invertebrates, including dragonflies, moths, butterflies and an alpine weka (DOC, 2004).

Like other alpine environments around the world, the Park is currently experiencing rapid change to its glacial landscape (Wilson et al., 2015). Being of a highly dynamic nature, the Park's glaciers offer a number of tourism and recreation-based opportunities for visitors.

Drastic fluctuations in the appearance of these features have the potential to challenge their viability as a tourist attraction (Stewart et al., 2016). The Tasman Glacier, arguably the most frequently utilised by the Park's visitors, has endured significant ice loss, shedding its volume at about 0.1km^3 annually (Purdie, 2013). As well as this, the Tasman's proglacial lake increased in surface area by 86 per cent between 2000 and 2008 (Quincey & Glasser, 2009; Dykes, Brook, Robertson & Fuller, 2011), now covering an area of approximately 7km^2 and is up to 240m in depth (Figure 3.2) (Purdie et al., 2015).

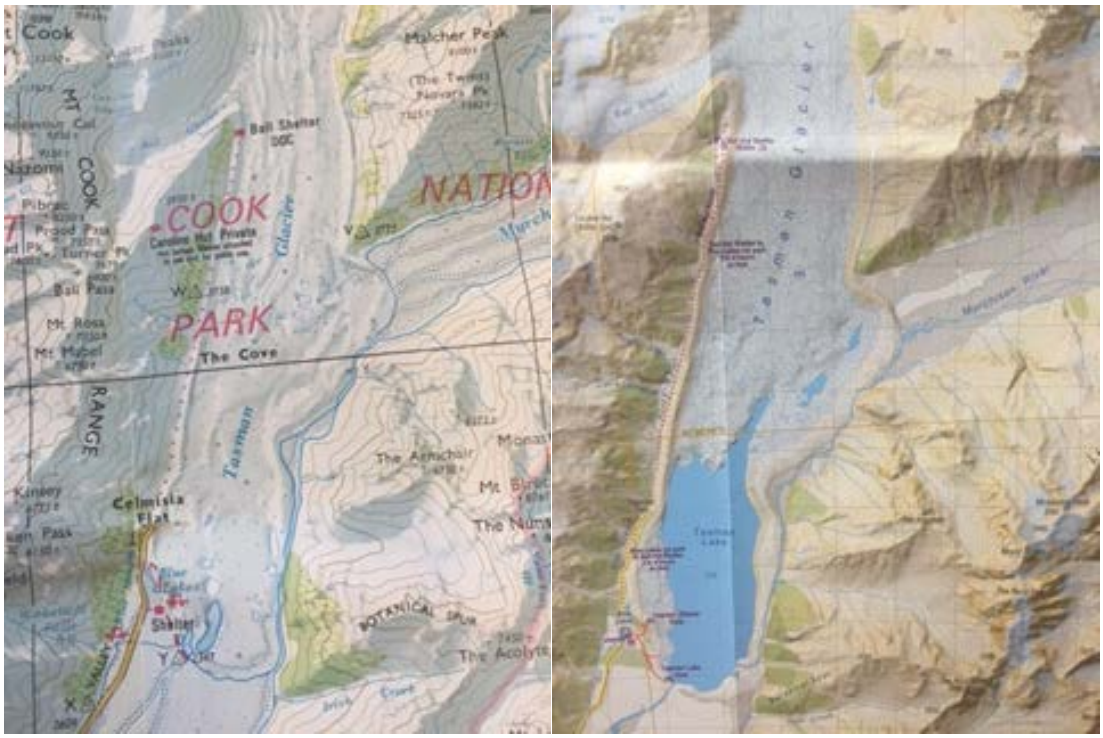


Figure 3.1: Rapid increase in the size of the Tasman Glacier Lake between 1991 and 2013 (Images from topographic maps by Jessica Hughes Hutton)

The significance of glacial recession in the Park has already resulted in major impacts on visitor access and scenic amenity (Wilson et al., 2015), perhaps the most obvious case being the development of the proglacial lake tourism activities on the Tasman Glacier. Estimates on just how large and how quickly the lake will grow have been regularly debated by scientists, with

the latest predictions suggesting that lake could expand a further 10 kilometres up the valley within the next 50 years (Dykes et al., 2011; Purdie et al., 2015).

The growth of proglacial lake tourism is not the only implication of glacial recession in the Park, however. Recreationists have reported a dramatic change in the accessibility of some high-alpine huts and climbing routes (Wilson et al., 2015), as well as changes in slope stability due to ice volume loss (McColl, 2012). Additionally, the natural hazard potential in the Park is increased dramatically as a result of mass movements of ice, debris and rock (Purdie et al., 2015), potentially putting backcountry recreationists and infrastructure at risk.

3.3 Tourism and recreation history

Aoraki/Mount Cook National Park has a long history of tourism and recreation and associated services. The first Hermitage hotel was built in 1884 at White Horse Hill, which is now the site of the campground. After it was destroyed by flooding from the Mueller Glacier, a second hotel was built in the existing village in 1912-13 before that too was destroyed in 1957 by fire. The current Hermitage Hotel was built in 1958 and has been operating ever since, with extensions in 1961, 1977 and 2001. In the 1950s, recreation clubs also began constructing accommodation buildings near the village. The Unwin Lodge, previously named the Unwin Hut, was opened in 1951 by the New Zealand Alpine Club (NZAC), while the Wyn Irwin Hut was built by the Canterbury Mountaineering Club and the Thar Lodge by the Deerstalkers' Association in 1956-57 (Wilson et al., 2015).

The early 1900s saw the first motor services to Aoraki/Mount Cook, with the road from Pukaki into the Park being sealed in 1975, and scheduled flights to the Park began in 1961. The airport

terminal was rebuilt in 2001 following a fire and now services a range of scenic flights, including both fixed-wing planes and helicopters (Wilson et al., 2015).

The Hooker and Mueller Valleys were established as Recreation Reserves in 1885, followed closely by the Tasman Valley in 1887. These are the most visited areas in the Park today, and have been the target of most new developments over the last decade including the introduction of boat-related activities on the Tasman and Mueller Lakes, upgrades to the Hooker Valley Track with the construction of three new bridges, the replacement of the Mueller Hut and the sealing of the Tasman Valley Road to the Blue Lakes carpark (DOC, 2004).

The Park also has a proud history as a significant climbing destination, with the first attempt to summit Aoraki/Mount Cook made in 1882. Since then, the Park has become recognised as one of the best mountaineering areas in the world (Wilson et al., 2015). There are 15 backcountry and alpine huts, which are utilised by trampers, hunters and mountaineers. During this time of rapid change, the accessibility of some of these huts has reduced dramatically, and some have been removed entirely. Hooker Hut, for example, became inaccessible due to thinning and slope erosion, leaving the hut hovering on the edge of the moraine wall above the Hooker Glacier. The hut used to be a common overnight shelter for climbers completing the east-west crossing of the Copland Pass. Although efforts were made in an attempt to uphold access of the hut by relocating it away from the edge of the glacier, it was finally removed in May 2015 (DOC, 2004).

Visitor activity within the Mackenzie area occurs en-route to, within, and outside the Park's boundaries (Booth & Cullen, 2001). DOC has recently reported an estimation of more than half a million international visitors to the Park over the next year, with the majority of climbers, trampers and tourists visiting between November and April (Cavanagh, 2016). In

contrast to past years, where the Park would typically experience a 'shoulder season' during the winter months, a range of recreation activities are now attracting visitors during this period as well, including heli-hiking and ski touring.

3.4 Management context

National parks are areas that are preserved and protected for the benefit, use and enjoyment of the wider public (National Parks Act, 1980). As is the case for all national parks in New Zealand, Aoraki/Mount Cook falls under jurisdiction of the Department of Conservation (DOC). Each park has a Management Plan which provides both day-to-day and long-term management objectives for natural and historic resources within these areas. The current Management Plan for Aoraki/Mount Cook National Park was written in 2004 and is currently being reviewed by DOC under the National Parks Act 1980, which requires all plans to be revised every 10 years. The General Policy for National Parks, the Canterbury Aoraki Conservation Board, as well as DOC's own Statement of Intent, are also assisting the direction of the plan's review (DOC, 2004).

As the plan is now 13 years old, it is an ideal opportunity for DOC to explore the ways in which the Park is currently being managed. Given the challenges that the Park is experiencing, the review has a specific focus on the effects of climate change and access issues caused by glacial retreat and destabilising of the glacial valleys (DOC, 2004). The increase in visitor numbers and the changing visitor demands will require improved management strategies to ensure that quality visitor experiences are being provided in light of the changing climate.

As the agency responsible for the management of visitors to the Park, one of the principal functions of DOC is to facilitate appropriate visitor use by providing a range of recreation opportunities within particular management settings that are not inconsistent with the broader conservation aims or detract from the desired experiences of visitors (DOC, 2009). The Recreation Opportunity Spectrum (ROS) is the planning approach used in New Zealand to identify these visitor management settings, and has a strong influence on the overall nature and standard of facilities at national parks. The Aoraki/Mount Cook National Park Management Plan (DOC, 2004) has adopted five settings appropriate for visitor management at the Park based on the Department's national Visitor Strategy (1996), which identifies seven representative visitor groups in order to assist in management approaches. Table 3.1 demonstrates the ways in which the two frameworks of visitor management settings and visitor groups are cross-referenced in Aoraki/Mount Cook National Park.

Table 3.1: ROS Settings and DOC Visitor Groups at Aoraki/Mount Cook National Park (DOC, 2004)

ROS Setting	**Front-country (Short-stop)**	**Backcountry Accessible – Motorised**	**Backcountry Walk-in**	**Backcountry Remote**
General Description	Short walks (max 1hr return) set in relatively natural settings, readily accessible by road	Large scale natural settings, within 2hrs walk to minor roads, 4wd vehicle tracks and high use aircraft landing sites	Typically popular walks/tramps within large scale natural setting.	Typically the untracked or low use bulk of the backcountry
DOC Visitor Group	**Short-stop travellers**	**Day visitors, overnighters, backcountry comfort-seekers**	**Backcountry comfort-seekers, backcountry adventurers and remoteness seekers**	**Backcountry adventurers and remoteness seekers**

The primary visitor groups at Aoraki/Mount Cook National Park are short-stop travellers, day visitors, overnighters and backcountry-comfort seekers within the front-country and backcountry accessible settings, as well as backcountry adventurers and remoteness seekers within the backcountry walk-in and backcountry remote settings. Other than those using the aircraft scenic landing services or those visiting Mueller Hut, the Park is not seen as a primary location for backcountry comfort-seekers. The seventh DOC visitor group, 'thrill seekers', has not been a focus for those managing the Park. Although activities such as mountaineering display elements of thrill seeking, they are classified by DOC as backcountry adventurers or remoteness seekers (DOC, 2004).

3.5 Chapter summary

Given the Park's popularity as a visitor destination, as well as the physical changes that the natural landscape is currently experiencing, it is now both critical and timely to investigate the implications of climate change on the overall visitor experience. Even more specifically, with the Management Plan (2004) currently under review, and the difficulties around glacier access being a key concern for park managers, it is important to explore the ways in which visitor access and the scenic amenity of the Park's glaciers have been impacted. In light of these research opportunities, the following chapter will describe the methodological approach used in this study.

Chapter 4

Methods

4.1 Mixed-method approach

Given that this is a relatively new field of research and exploratory in nature (Welling, 2015), this study suited a mixed-methods approach. According to Cresswell, Plano Clark, Gutmann and Hanson (2003), the collection and integration of both quantitative and qualitative data in social science research can significantly strengthen a study and assist in neutralising or cancelling out the limitations of certain methods if used on their own. For example, they argue that the detail of qualitative interviews can provide in-depth insights not offered through quantitative surveys. Similarly, it is claimed that using a mixture of methods is required to best understand the complexities of social phenomena (Greene and Caracelli, 1997).

The purpose of this chapter, therefore, is to describe the mixed-methods approach used in this study. The first two sections give an in-depth explanation of the quantitative and qualitative approaches used, followed by a description of how the data were analysed in the third section. The fourth section acknowledges the limitations of the study, before the chapter briefly summarised[1].

4.2 Quantitative method - visitor survey

The first stage of the study involved a researcher-administered survey approach to gather data from a range of glacier visitors who were categorised into the following groups: (1) visitors to front-country zones including the village area and surrounding tracks; (2) visitors

[1] The project was reviewed and approved by the Lincoln University Human Ethics Committee on the 9th of December 2016 (see Appendix J).

accessing the glaciers as clients of commercial guided operations; and (3) back-country recreationists who seek more remote settings within the Park or have used the Aoraki/Mount Cook setting extensively over the years for their outdoor activities (see Appendix A). The survey collected information on the visitors' demographic characteristics, activities undertaken while in the Park, awareness and experience of the Aoraki/Mount Cook glaciers, expectation and satisfaction levels of various aspects of the Park, and general attitude towards climate change.

In total, 400 surveys were completed by English-speaking visitors over two ten-day periods during the summer of 2016/17: (1) December 28th 2016 – January 6th 2017; (2) February 8th – February 17th 2017. These dates were chosen to ensure that New Zealand visitors would be well-represented in the post-Christmas period, as well as to accommodate for usual trends in visitor numbers and weather conditions around this time. For example, December-January normally corresponds with high visitor numbers and February with more stable weather patterns. This same approach, with very similar dates, was demonstrated in a visitor survey undertaken at the Franz Josef and Fox Glaciers in 2013-2014 (Wilson et al., 2014). Surveying was undertaken on all ten days of each survey period and 200 surveys were completed in each of the two data collection periods (Table 4.1).

Table 4.1: Number of surveys by survey period

	First survey period	Second survey period	Total
Tasman Valley	26	18	**44**
Hooker Valley	25	23	**48**
Sealy Tarns	-	28	**28**
Mueller Hut	-	40	**40**
Visitor Centre	143	84	**227**
Unwin Lodge	6	5	**11**
On-line	-	2	**2**
Total	**200**	**200**	**400**

Visitors who were selected, and agreed, to participate were given a laminated booklet as a visual aid to help them answer the scale-type questions more easily. The researcher asked the questions, all of which were simple numerical selections, and recorded the participants' responses. This researcher administered surveying approach ensured that all questions were understood by the participants, data was recorded accurately, and no questions were missed. It also meant that the burden of compliance on participants was reduced, given that they were not required to fill out the surveys themselves. The survey was conducted in English and took approximately 10 minutes for participants to complete.

An on-line version of the same survey was also made available for those visitors who were unable to complete the survey at that particular time. These visitors were given a card with a QR code and web address (see Appendix C) that allowed them to complete the survey at a later date. Two hundred of these cards were left at the airport in order for staff to hand them to clients once they had completed their flights. Altogether, only two people completed an on-line survey.

4.2.1 Survey sites

The various visitor groups had been identified prior to data collection commencing using the management plan (DOC, 2004). The reason for this recruitment strategy was to ensure that the groups were appropriately aligned with DOC's current visitor management frameworks, and to capture a range of visitor activities related to glacier tourism and recreation. The sampling locations (Figure 4.1) were selected in order to capture those visitors who were independently walking the Park's tracks to the glacier viewpoints, those who were returning from commercial activities, as well as those who were about to set out on, or had recently returned from, a more adventurous trip in the mountains.

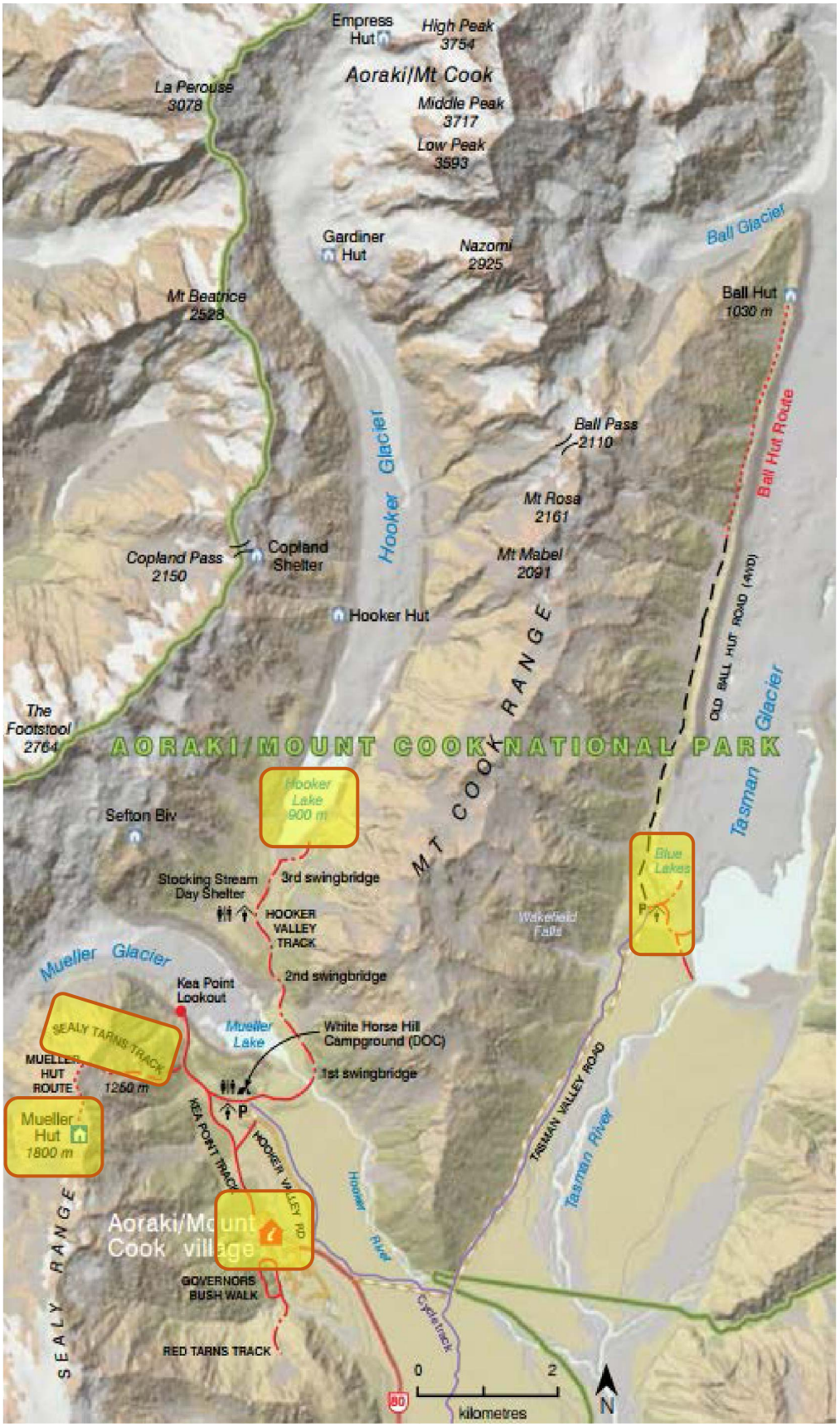


Figure 4.1: Park map indicating survey site locations

As it was not possible to gain permission for surveying commercial visitors immediately after the conclusion of their glacier activities at the Aoraki/Mount Cook Airport or at the Hermitage, it was decided that these visitors would also have to be recruited on the walking tracks, assuming that some of them would undertake other activities during their time in the Park. The researcher dedicated specific survey sessions to asking visitors if they had taken part in any commercial activities within the Park as a screening device to capture commercial recreationists. This was done by showing the visitors a laminated card with images of a scenic flight, glacier landing, kayak and boat tour, and an argo ride (see appendix D). If visitors had completed one of these activities, they were asked if they would be willing to take part in the survey. This technique was used at both the Tasman Glacier viewpoint and the visitor centre for a total of 4 hours at each location. In addition, cards for the on-line version of the survey (see Appendix C) were given to the front-of-house staff at the airport for them to give out to clients who had just returned from scenic flights or glacier landings.

Given the length of the survey and the time needed to complete it, it was agreed with DOC representatives that surveying would take place in specifically chosen areas of the Park where visitors were likely to be at their leisure. Using a script from the first page of the survey, visitor groups were approached by the researcher and asked if they would be willing to participate in the study. Only one person from each group over the age of 18 was invited to complete the survey, and that participant was recruited as a result of having the next birthday in the group. Participants were offered an information sheet, giving a full explanation of the research, what would be required of them and their rights as participants of the study, as well as full contact details of the researcher and supervisors. Participants were also told that although this was an independent study, it had the full support of DOC.

4.1.1.1 Tasman Valley

The researcher had originally planned to survey at the Tasman Shelter, based at the beginning of the track near the carpark. It became apparent very quickly, however, that many visitors were in a rush to get back to their cars and were not very willing to take part in the survey.

The new survey site, therefore, was at the glacier viewpoint where visitors were usually seated or reading the interpretation panel. Although this site was not very large in area, there were big, flat rocks that the researcher and participants could comfortably sit on while completing the survey. The location offered very little shade and was incredibly exposed to wind, and therefore surveying at this site usually only took place during the morning hours on clear and calm days.

Figure 4.2: Survey site Tasman Valley
(Photo credit: Jessica Hughes Hutton)

4.1.1.2 Hooker Valley

Surveys were undertaken at the large glacier viewpoint at the end of the Hooker Valley Track. This is a spot where visitors had just completed a five kilometre walk, and were often seated

at the large picnic tables, or slightly further down at the edge of the glacier lake. This was a popular spot for people to bring their lunch and relax after a long walk, however did not offer any shade and was approximately a 20 minute walk to the nearest toilet facility. Most of the surveying at this location took place during the middle of the day or in the evenings when the temperatures were slightly cooler.

While it is acknowledged that not all walkers on the Hooker Valley Track reach the viewpoint, the terminus setup worked well for surveying and the majority of people were willing to take the time to participate.

Figure 4.3: Survey site Hooker Valley
(Photo credit: Jessica Hughes Hutton)

4.1.1.3 Aoraki/Mount Cook National Park Visitor Centre

Due to particularly unfavourable weather conditions on many of the surveying days, the researcher was granted access to the visitor centre by DOC. This location was well utilised during these rainy and windy periods, and many visitors were willing to take part in the

survey. The majority of surveys in the visitor centre took place downstairs where there were plenty of seating options available.

The visitor centre is often the first place that visitors go to upon arriving at the Park in order to plan their activities. Many of the participants recruited in this location had only just arrived in the Park, and had therefore not yet undertaken any activities outside of the visitor centre.

Figure 4.4: Survey site Visitor Centre (lower level)
(Photo credit: Jessica Hughes Hutton)

4.1.1.4 Sealy Tarns

After climbing 2200 steps to reach the viewpoint, this location was ideal for surveying visitors while they were resting. The site has a picnic table and plenty of places for people to sit and have their lunch, while providing good views of both the Hooker and Mueller Glaciers.

Figure 4.5: Survey site Sealy Tarns
(Photo credit: Jessica Hughes Hutton)

4.1.1.5 Mueller Hut

More advanced than the valley-based track settings, the Mueller Hut is a popular destination for many both overnight and full day walking backcountry visitors. Sleeping a total of 28, the hut was a good site for capturing both day and multi-day trampers. The majority of the surveying was done on the balcony of the hut, where the walkers were likely to be sitting and eating their lunch or enjoying the view. The kitchen seating area was an ideal space for surveying the walkers who were staying the night in the hut, and this was predominantly done in the early evening when most people were relaxing and socialising with one another.

Figure 4.6: Survey site Mueller Hut
(Photo credit: Jessica Hughes Hutton)

4.1.1.6 Unwin Lodge

Part of the New Zealand Alpine Club network, Unwin Lodge is situated at the entrance of the Park and is the start and end point for many alpine enthusiasts and guided groups. As the base for the researcher, the lodge provided ample opportunity for recruiting these backcountry users. Due to the fact that the majority of recreationists had not yet started their trip at the time of recruitment, most were given a card to complete the survey on-line at a later date.

4.3 Qualitative method - key informant interviews

The second phase of data collection employed a qualitative research approach involving semi-structured face-to-face interviews. Twelve key informants were selected and interviewed based on their significant association with Aoraki/Mount Cook National Park and their involvement with glacier tourism and recreation. The respondents included planners and managers from the Department of Conservation, glaciologists, recreational and professional alpinists, and glacier tour operators.

Many of the respondents, particularly within the Aoraki/Mount Cook community, were known to the supervisors of this research as a result of engagement in previous projects. Furthermore, contact recommendations were frequently given from participants after they had completed their interviews, and therefore a number of potential respondents were contacted at short notice once the lead researcher was in the Mackenzie region. Initial contact to all potential interviewees was made via email with a research information sheet explaining the study in detail (see Appendix G).

The interview instrument was designed to support and complement the questions asked in the visitor survey. The same schedule of questions was used in all interviews. Due to the key informants' area of expertise and direction of conversation being different in all interviews, however, the full set of questions was not always used, and in some cases, additional questions were asked of interviewees where relevant.

The original interview schedule (see Appendix F) covered the following topics: (1) background information on each key informants' personal and/or professional involvement with tourism and/or recreation in Aoraki/Mount Cook National Park; (2) the importance of Aoraki/Mount Cook National Park to each respondent personally, as well as the perceived level of importance of tourism and/or recreation in the Park; (3) the overall experience of visitors to the Park and what characteristics of the Park are perceived to be important in terms of visitor attraction; (4) perceptions of glacier importance and attraction, as well experiences of glacier change over time; (5) key informants' perceptions of climate change in the context of tourism and recreation, including overall awareness and adaptation strategies; (6) the key informants' concerns for the future of the Park and what they view as the major challenges and implications for planning and management.

All key informant interviews were undertaken during the quieter months of April-June 2017 after the typically busy visitor and climbing summer period. In total, eight of the interviews were conducted in the Mackenzie Basin region: four in Aoraki/Mount Cook National Park itself, two at the nearby Glentanner, and one in each of the two nearest townships, Twizel and Lake Tekapo. The remaining four interviews were conducted in the city of Christchurch, one of which was via Skype call. The majority of interviews took between 30 minutes and one hour to complete. All interviews were digitally recorded and transcribed in full.

4.4 Data analysis

Data from the surveys were entered into an Excel spreadsheet before being processed and analysed using SPSS. Any questions which required an additional open-ended response were recorded verbatim, and later post-coded and analysed. Due to the data being researcher-administered, the data set was complete, however some questions did not apply to certain participants. For example, those participants who had not recalled seeing a glacier during their trip at the time of the survey were not able to give their opinion of the glaciers' appearance, and those who had not yet undertaken any activities outside of the visitor centre could not comment on their satisfaction of particular visitation factors.

Key informant interviews were analysed by searching for consistent emerging themes (Lofland & Lofland, 2006). In order to protect the anonymity of participants, broad descriptors indicating the interviewees' type of involvement have been used to acknowledge any quotations.

4.5 Limitations

As is common in most field-based studies (Wilson et al., 2014), there were some challenges that need to be acknowledged, particularly in regard to the visitor survey. The obvious limitation of surveying in a glacier region is the weather. Although there were no extreme weather events during either of the two survey periods, rainy days did disrupt surveying outside to a considerable extent. Due to many of the commercial glacier activities relying on clear weather, this meant that many visitors were using the visitor centre rather than being outside, and therefore the use of the building for conducting surveys was very useful. On the other hand, however, this also meant that many of the participants recruited in the visitor centre were short-stop travellers and were not planning on venturing any further than the village, and were therefore not able to be asked the glacier-specific questions. While administering surveys in the visitor centre, the researcher took considerable care to ensure that respondents were aware that the study was not being undertaken by DOC, and all relevant feedback specific to DOC's work was passed on immediately.

There was also a lack of access to certain visitors groups as a result of language barriers and difficulties in recruiting respondents who were part of an organised tour group. Therefore, it is likely that Asian visitors are significantly underrepresented in this study. The lack of uptake for the online version of the survey was also a major limitation in recruiting commercial tourists.

4.6 Chapter summary

This chapter described the mixed-methods approach used to gather information from 400 visitors and 12 key informants. This style was chosen in order to increase the credibility and validity of the study, as well as to maximise understanding (Cresswell et al., 2003). The following two chapters present the results of the research, integrating both quantitative and qualitative data to best reflect the key objectives of the study described in the first chapter.

Chapter 5

The nature of glacier tourism and recreation and the current glacier visitor experience at Aoraki / Mount Cook National Park

Although the data collection phase in this study comprised two very separate stages, the two results chapters integrate data from both visitor surveys and key informant interviews. Comprising five sections, this chapter focuses on the first two objectives of the study: the nature of glacier tourism and recreation; and the current glacier visitor experience. The chapter first presents a profile of the survey participants, followed by a description of the key informant interviewees. The third section describes the various ways in which the Park is important to the key informants, before presenting findings aligning with the glacier experience, including the level of awareness surrounding the glaciers and the significance of the glaciers in terms of visitor attraction. Finally, results are presented in light of the study's three visitor types described in the previous chapter; backcountry recreationists, front-country tourists and commercial glacier tourists, before the chapter is briefly summarised.

5.1 Visitor profile

Just over a third of all visitors surveyed were aged 20-29 years (34.8%, *n*=139) and just over a quarter were aged 50 years or older (26.3%, *n*=105). These findings are consistent with the age profiles of glacier visitors from previous studies (Stewart et al., 2016; Wilson et al., 2014) and the outdoor recreation and tourism literature more generally (Manning, Lawson, Newman, Laven & Valliere, 2002; Newsome et al., 2013). Similarly, there was roughly an equal gender split in total across the two survey periods (women, 52.5%; men, 47.5%). The total

sample figures for both men and women were almost identical to the visitor survey undertaken at the Franz Josef and Fox Glaciers in 2013-2014 (Wilson et al., 2014).

As is commonly reported elsewhere in the research literature, (Manning et al., 2002; Booth and Peebles, 1995), the visitor sample was highly educated. Over three quarters of all survey participants reported having a university education (79.3%, *n*=317).

Of the total sample, international visitors accounted for 74.2 per cent (*n*=297) and New Zealand residents 25.8 per cent (*n*=103). The most common countries of residence for international visitors were Australia (13%, *n*=52), Germany (13%, *n*=50), the USA (12%, *n*=47) and the UK (8%, *n*=31). Visitors from other European countries made up 19 per cent (*n*=75) of the total sample (Figure 5.1).

Almost twice as many New Zealanders were surveyed in the first survey period compared to the second which is highly indicative of the Christmas/school holiday period. By contrast, visitors from European countries were more than twice as likely to be encountered in the second survey period and this could very well be a result of these travellers purposely avoiding the New Zealand summer/holiday period.

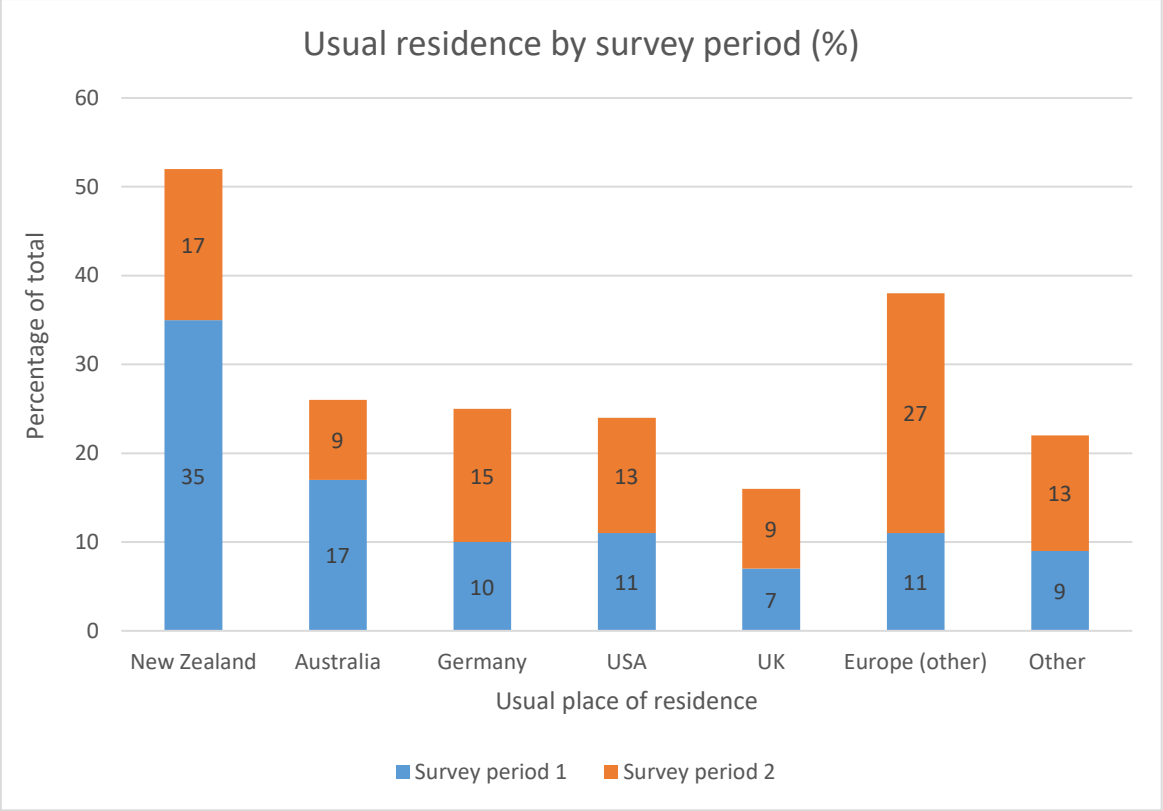


Figure 5.1: Usual residence by survey period (*n*=400)

Those participants who indicated that they normally lived in New Zealand were then asked to specify which region they were from. Unsurprisingly, the two most common regions reported by New Zealand visitors were Canterbury (28.2%, *n*=29) and Otago (22.3%, *n*=23). This was followed closely by Auckland (16.5%, *n*=17).

Consistent with the fact that most respondents were from outside New Zealand, the majority were visiting Aoraki/Mount Cook National Park for the first time (77.5%, *n*=310). Of those who had been to the Park previously, most (62.6%, *n*=55) had visited within the past 17 years (2000-2017) and 79 per cent (*n*=70) had estimated to have visited the Park two and five times before.

The majority of the sample were visiting the Park with family members (53%, *n*=212), followed by 23.3 per cent (*n*=93) visiting with friends, and 16.8 per cent (*n*=67) visiting alone. Almost all the respondents (94.4%, *n*=379) were visiting in groups of between one and five people, and most commonly, visitors (39.5%, *n*=158) were staying in the Park for at least one night from the time of survey completion.

5.2 Key informant description

Altogether, seven of the twelve key informants interviewed lived and worked at Aoraki/Mount Cook National Park. The other five lived elsewhere, but were still associated with the Park in various work-related roles. Three respondents either managed guiding companies or worked as guides (mountaineering, heli-hiking, ski touring, glacier guiding) within the Park, however a number of the other respondents had also worked within the alpine climbing industry in previous years; all of whom had also worked in other mountainous regions both in New Zealand and overseas. Three respondents were involved in tourist activity businesses, two as pilots and one in accommodation, while four worked with DOC as a conservation planner or park managers. The remaining two respondents were geologists. In many cases, respondents had held different roles in the Park over time, and it was also common for respondents to have utilised the Park for their own recreation before taking up a professional role.

The key informants had been associated with Aoraki/Mount Cook National Park, both professionally and recreationally, for between five and 47 years. Only one respondent had fewer than ten years' association, while the remaining respondents had been associated with the Park for twenty years or more (Figure 5.2). The average length of association was

approximately 34 years. As shown in Figure 5.2 there was a relatively even spread of length of association, with respondents from planning, managerial, guiding, operating, and scientific backgrounds all reporting long associations with the Park.

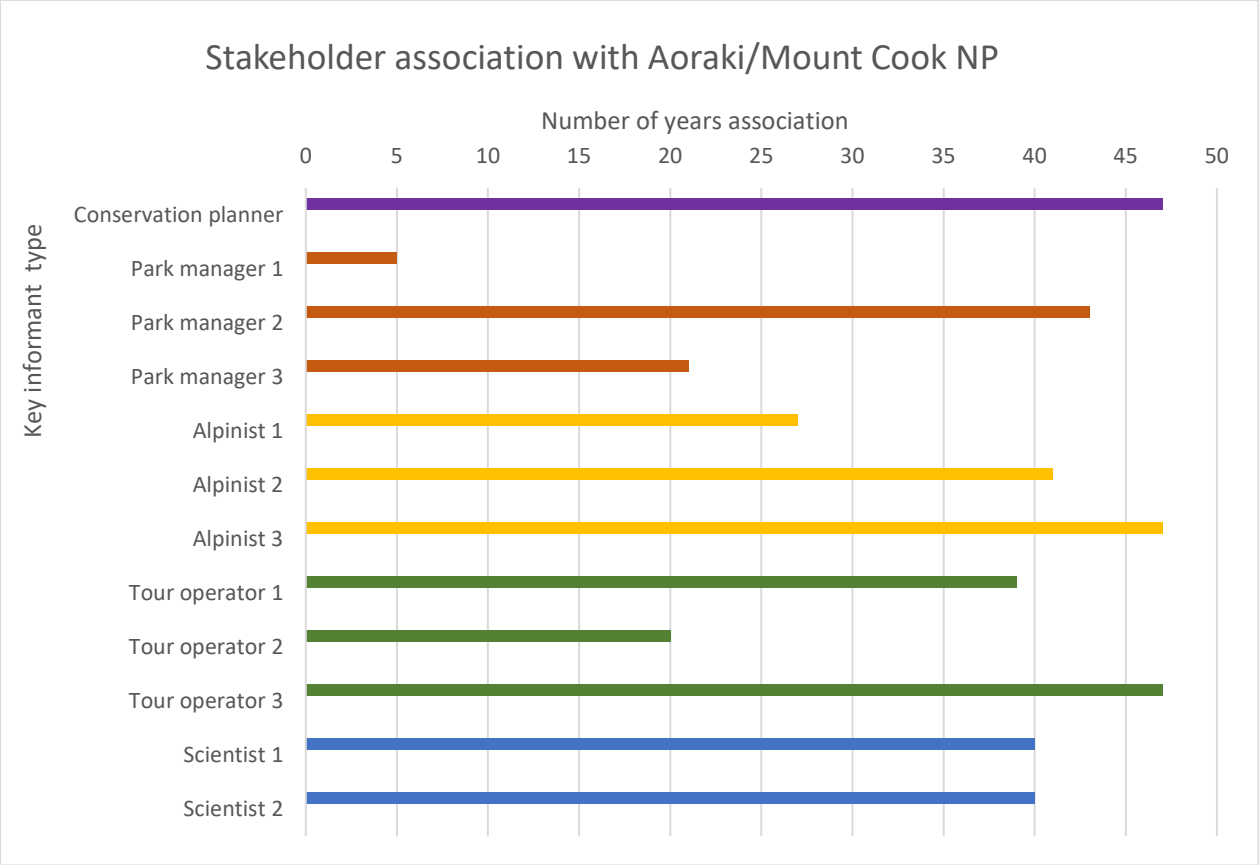


Figure 5.2: Respondents' involvement type and length of association with Aoraki/Mount Cook National Park

General descriptors indicating the respondents' type of involvement with the Park have been used to protect anonymity when attributing quotations. No business-related information is reported in the thesis.

5.3 The importance of Aoraki / Mount Cook National Park to key informants

This section presents results drawing on the meaning and importance of the Park from the perspective of the key informants, including respondents' emotional attachment and reliance on the Park. The findings will also present the significance of the Park in terms of the history of tourism and recreation, as well as the importance of the setting as a visitor attraction from both a visitor and key informant perspective.

5.3.1 Emotional attachment

A key theme that emerged when respondents were asked to describe what the Park meant to them personally was the idea around emotional attachment. For many of the respondents, Aoraki/Mount Cook had been their place of residence, or 'home', for a number of years. Many talked about raising their families in the village and how the Park had become a part of their identities. For example, two residents of more than 20 years noted *"it's the place that I've spent the longest in my life, and both our children were brought up here, so it's their home" (Park manager 2)* and *"it has a sense of identity for my family as well, so for my daughter it's home" (Park manager 3).*

It was also reported by many that the mountains and the natural environment hold great personal significance as well, particularly among those who had lived or worked in the Park long-term:

> *I'm very attached to mountains […] I guess I view the Park in a spiritual kind of way. To me, that's my big backyard and seeing it looked after and having it there for people to be able to access, to be able to get close to the mountains and interact with the landscape and nature, is incredibly important to me […] I've always had a really strong connection with the mountains and so I really like to do my bit to ensure that it stays nice (Scientist 1).*

A tour operator also claimed:

> *I've got a great love for the area […] I've had a very long association with the area and I have a great affection and still enjoy walking up the Hooker, even though it's a bit like a main highway now (laughs), but I still enjoy spending time in the Park (Tour operator 3).*

5.3.2 Livelihood reliance

The reliance on the Park for the success of their employment was also noted by several key informants. One respondent who had been involved in the management of the Park for five years talked about how the importance of the Park to his role had increased with time:

> *Well it has increased in importance as my role and association with it has changed. So since I've been in this role and responsible for the management of [the Park] clearly it has a huge priority and the importance is huge as well. And I can understand, you know, the value of it even more so being responsible for managing it (Park manager 1).*

A pilot who had worked in the Park for nearly 50 years summed up the importance of the Park to his business:

> *[…] it's really important to our business and it gives us a reason to keep going I suppose. And the biggest source of enjoyment in this job is just the amazing pleasure it gives other people to see the area when we fly them round and the reaction we get after they have finished the flight, you know it keeps you pretty buoyed up (Tour operator 3).*

In contrast, a tour operator who had been associated with the Park for more than 30 years also noted the importance of tourism businesses to the Park and the people who visit:

> *People want to do things in the Park other than just walking, although I would say that walking is the most popular activity in the Park. Others want to access the higher areas, so businesses must have concessions to operate on any conservation land and also in Aoraki. It's very important for businesses to be able to operate there (Tour operator 1).*

5.3.3 Cultural / historical significance

Those key informants whose experience included climbing and tramping in the Park for many years also talked extensively about the importance of recreation in the Park and emphasised the cultural and historical significance of Aoraki/Mount Cook as the *"pre-eminent climbing area of New Zealand" (Conservation planner).* The following quotation illustrates this:

> *Back in the early 1800s when people started coming from overseas, it was trying to be the first up Mount Cook and then that spurred a lot of kiwis as well into trying […] it's like the home of mountaineering in New Zealand. All our peaks over 3,000 metres are in Westland or Aoraki, with the exception of wee old Aspiring tucked further down, so I guess from a climbing perspective, you can go there and there's lots and lots and lots of different things that you can do. You might go there not to just climb Mount Cook, but to climb Tasman or Sefton or Footstool, there's this whole raft of mountains. So from a mountaineers' perspective it's a key place in New Zealand with lots of choice (Scientist 1).*

A few others also noted the importance of the Park in terms of the history of New Zealand's national parks in general, as the quotation below illustrates:

> *It's important to me in terms of the history of national parks in New Zealand. It's one of the first, not the first, but one of the first national parks. It was one of first protected areas before we started creating national parks, so the original reserve which was in the lower Hooker, I think, dates way back to the late 1800s, so it's very early. So it's very important in terms of preservation and protection in New Zealand (Conservation planner).*

Similarly, an alpinist discussed the values associated with national parks:

> *I mean, national parks in general are really important. So this one is kind of unique, it's got a lot of cultural values attached to it, it's got a lot of historical values attached to it, it's certainly got a massive amount of recreational value attached to it, as well as the flora, the fauna, the geology, the glaciation is a huge part of it as well because it is one of these unique parts of the world (Alpinist 1).*

A scientist also spoke of the historic role of tourism and recreation in national parks:

> *[…] in many ways, of all the parks in New Zealand, it has got a strong recreational and tourism grounding that I think is actually inherently part of it. And I think to not manage the Park in a way to maintain those things, in some ways would be a disservice to what that Park was all about and why people wanted to turn it into a national park in the first place (Scientist 1).*

In addition, many respondents talked about the significance of Aoraki to Ngai Tahu and the responsibility they felt to protect that relationship. One respondent who had been associated with the Park for over 40 years reported that *"the whole mountain is really important to Ngai Tahu obviously, and how you approach the mountain and the whole methodology of Aoraki" (Conservation planner).*

5.3.4 Visitor attraction

Survey respondents were also asked to reflect on the importance of the Park, by asking them what influenced their decision to visit the Park (Figure 5.3), the three most important factors were 'being close to nature' (89.3%, *n*=357), 'the opportunity to witness Aoraki/Mount Cook itself' (87.1%, *n*=348), and 'experiencing a sense of discovery' (72.8%, *n*=291)[2].

[2] A 7-point scale was collapsed in order to present the results of those respondents who scored each factor with a 5, 6 or 7.

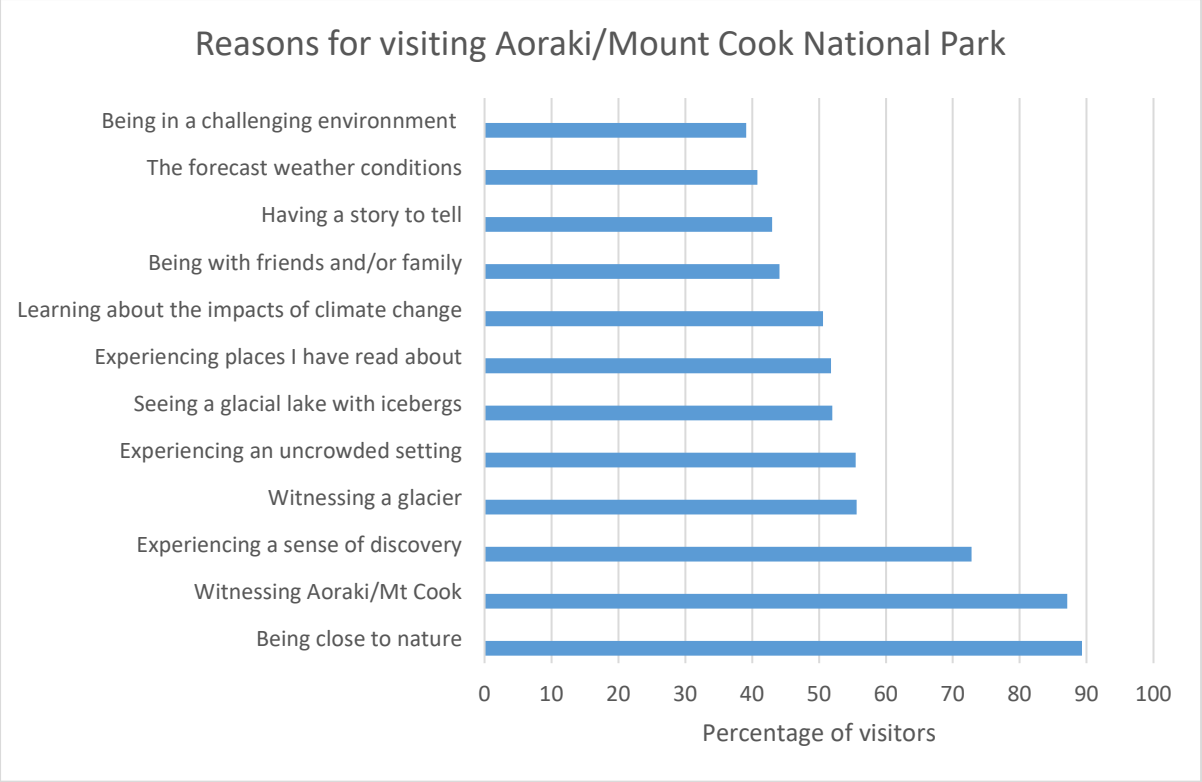


Figure 5.3: Reasons for visiting the Park (*n*=400)

Interestingly, when asked about the importance of the Park in terms of its status as a visitor attraction, most key informants referred to the motives of the front-country tourists as opposed to the backcountry recreationists. As one of the park managers put it, *"it's an icon site, people come here to look at mountains. I think it's as simple as that" (Park manager 2).* All the key informants commented on Aoraki/Mount Cook itself being an extremely important factor in the decision for people to visit the Park:

> *I would say the big attraction is that it is Aoraki itself and it's where all our high mountains are and it's where you sort of, can't so easily now, get up close and personal with a glacier. The fact that you can be amongst these big mountains is what's drawing a lot of people (Alpinist 1).*

Similarly, a tour operator claimed:

> *It's because of its natural beauty, it's because of Aoraki. That's one hundred per cent why. Not because of the activities, they go there because they want to see that and then they do the activities as an aside (Tour operator 1).*

A scientist agreed:

> *I think undoubtedly, it's human nature. It's the biggest mountain. So people want to go to the biggest this, the fastest that, and it is the biggest mountain. So if you're going to go to one mountain in New Zealand, it's going to be Mount Cook (Scientist 1).*

The survey findings confirm this claim, as more than half (56.3%, *n*=225) of the visitors sampled rated 'the opportunity to witness Aoraki/Mount Cook' as 'very' important' (7, on the 7-point scale) in their decision to visit the Park.

Many key informants also talked about the mountainous landscape more generally as being important in terms of visitor attraction. One alpinist summed this up:

> *The attraction of being here is still the Park itself. It's not the hotels, or the huts, or the bridges. The attraction is actually that it gives people that ability to take one step off the track and look around and go "this is still natural country". We've built tracks, we've built huts, we've built roads to get people to these places, but the attraction is still looking out, not looking in (Alpinist 1).*

A park manager with long-term tourism involved also said:

> *It's got an icon walk and it's got an icon mountain. So you can still see icebergs in Hooker Lake, so the whole thing of walking towards the mountain […] so that's what is drawing the people in. Whatever they're there to do, whether they're just there to get a stunning photograph, whether they're there to do the walk, whether they're walking up to Mueller to get the sunrise or sunset on the mountains, whether they're just driving into the village to see Aoraki from the buildings, so the Hermitage is placed so that you look directly onto the mountain (Park manager 3).*

One key informant made a comment on the idea that visitors are able to create a story for themselves based on the natural landscape of the Park, *"I think one of the big attractions for Aoraki is that you can actually read the landscape and the landscape change and you can actually make quite a neat story about it which is an attraction in itself" (Conservation planner).*

A few others also compared the attractiveness of Aoraki/Mount Cook National Park to other places, both within New Zealand and overseas, as a conservation planner illustrated:

> *I think it is always going to be an attractive park and it is in its natural state. So if you compare that to going to Queenstown or Central Otago basin, they are poles apart in terms of one is very much highly modified, but everything from Lake Pukaki up is pretty much in its natural state (Conservation planner 1).*

Conversely, a tour operator talked about the accessibility of New Zealand's mountainous environment compared to other countries:

> *[…] the fact that everything is close together in New Zealand. Obviously other countries in the world, America and Europe, have bigger mountains and glaciers than ours, but here it's all very accessible and close together (Tour operator 3).*

The idea around accessibility and closeness was also a reoccurring theme among key informants. One park manager reported that *"it's all about access and access is a major, major driver for why people come here" (Park manager 1).* He also went on to add:

> *[…] it's that whole driver about the fact that you can get relatively close to the glacial environment and that whole idea of getting close to New Zealand's highest mountain, you know it's that whole proximity to things. You don't have to literally touch the top of Mount Cook, but it's that feeling of closeness that you can get […] physically you can drive close to it, you can walk relatively close to it, and if you want to spend the money you can fly close to it, or even land close to it. They are quite big drivers for why people come and visit here (Park manager 1).*

On the other hand, however, one key informant also touched upon the potential accessibility limitations due to the National Park being situated at the end of a one-way road:

> *It's a big decision, you know, to turn off at the turn-off down there because it is a dead-end road essentially, you have to have a motivation for coming up here and then going all the way back down. I tell people I've got a 55km driveway [laughs] (Park manager 1).*

This was also highlighted by another key informant, who had a much longer association with the Park, and seemed to think that limitations around road access were not so much an issue today as they had been in past years:

> *We went through a period where the isolation of this place was one reason why people weren't coming, the bus drivers would never come up the road, and we put a base at Pukaki Airport to try and trap them there. But that has since changed, the drivers now seem quite willing to drive up the road (Tour operator 2).*

Based on the findings presented in this section, the Park holds significant meaning and importance to the key informants, including a strong emotional attachment and livelihood reliance. The findings also show that the Park has a long history of providing tourism and recreation experiences.

5.4 The visitor experience at Aoraki / Mount Cook National Park

This section presents results drawing from the current nature of recreation and tourism at the Park. More specifically, the findings present the ways in which visitors are experiencing the glaciers, as well as the level of interest and awareness around them. Finally, the results look at visitor experience based on three identified groups: backcountry recreationists; front-country tourists; and commercial glacier tourists. The interview data suggest that all three of

these visitor groups have undergone considerable change over time as a result of new markets emerging and others declining.

5.4.1 Tourism and recreation history

The importance of recreation and tourism in the Park was noted by almost all the key informants. As one park manager with more than 30 years' experience reported, *"that's what the Park is about, tourism and recreation".* Another manager talked about the interconnectedness of the Park and the tourism industry, *It's the number one priority for this location […] you can't separate this location from tourism and I guess it's the major driver for why people visit (Park manager 1).*

A few of the key informants who had long associations with the Park discussed the history of tourism and recreation in terms of how it has evolved over time. A pilot with 20 years' experience summed this up:

> *Well it has gone through different phases, if you like. When I first came here it was probably the jewel in the crown of the tourism industry, and then it faded off and other places overtook the Mount Cook area, and a classic example of that is Air New Zealand pulling out of their scheduled service to Mount Cook Airport. And then it has come back a little bit now. So right at this point, we are, in my opinion, as busy as we were twenty years ago, but with quite a big lull in the middle where other places like Queenstown took over (Tour operator 2).*

A long-time recreationist also talked about the history of the Park's tourism and recreation from a climber's perspective:

> *It sort of started with the early surveyors, Brodrick and von Haast doing the whole creating a map, and then we had the actual guiding climbing where wealthy people would come from overseas […] and would get guided places. And the recreational climbing came almost a little bit later, once there was a development of crampons and ice axes and that [...] so I think it's got this grounding in both recreation and*

> *tourism. But there was quite a high-end tourism market there under the guides of mountaineering. And then we went through this phase of the bus tours […] but then they wanted to do more things in the valleys, so not so much mountaineering. And then we started getting more recreational climbers, so you started to see the mountaineering scene was starting to become more balanced with the recreational climbers and guiding companies, and then there was this mass of everyday people starting to do things in the lower valleys. And that's the thing that has really increased and increased (Scientist 1).*

She also went on to talk about her view on mountaineering in the Park today:

> *Now you've still got the mountaineering thing going on, but just I guess in terms of cost and lifestyle, people don't turn up for a month and go mountaineering, they turn up and want to fly in, climb Cook in two days and fly back out. So those tourists are quite different now, they're kind of in and out. And you might not even see them, they probably don't stay at the Hermitage anymore, they probably stay at the Alpine Club Lodge and away they go, whereas the mass of people that you see now are the everyday people cruising around and having a look themselves (Scientist 1).*

One key informant with only five years' experience talked about how visitor motives had remained consistent over time by suggesting the following:

> *I think those motives have been the same as they were probably a hundred and whatever years ago when they first created tourism infrastructure here. You know, that image that exists is largely still the same image with a few bits missing off it as things have changed over time. So I think it's probably no different to when the Hermitage first started up (Park manager 1).*

In contrast, he also went on to add that the increase in marketing may have influenced the growth in tourism in more recent years:

> *There's the way tourism is going at the moment, clearly it has been sold to people so there has been a degree of marketing of the place by Tourism New Zealand so it's on the 'must do list'. And that 'must do list' has sort of been created through social media and obviously active marketing of the place (Park manager 1).*

5.4.2 Significance of the glaciers

When asked about the role of glaciers in the Park, a few key informants talked about their importance in a geological sense. For example, one interviewee answered the question based on the glaciers' role in the wider landscape:

> *They are pretty fundamental really, without them you wouldn't have a park […] they have been incredibly important for access because you've been able to walk up them or ski up them or land on them. They have effectively propped up the mountains, they are what shapes the whole landscape. If I think about the smaller, higher glaciers, they are what gives you access to the higher mountains. The park would just be a pile of rubble without them (Conservation planner).*

Another spoke of the glaciers' role in backcountry access:

> *If you took them in one fell swoop and you removed them from this landscape, then it would be A) horrifying and B) really dramatic on the ability to be able to go anywhere close to the mountains, your approaches, your traverses, everything […] everything would be remarkably difficult to be able to get close to because the glaciers are the bridge, glaciers are what enable us to get near the rest of the mountains. If you just scooped them out and took them away, we'd just be left with steep rubble like you see out there […] (Alpinist 1).*

One park manager also noted the responsibility that he felt in maintaining visitor access to the glaciers:

> *I can't influence it much, but it's everything about this place really. And in a lot of respects, my role is about facilitating peoples' access to it, ensuring that we maintain those opportunities for people to actually see it (Park manager 1).*

A mountain guide talked about the importance of the glaciers in light of his own role in the Park:

> *[…] our company's commercial activities would be so severely depleted without the glaciers. Probably seventy-eighty per cent of our guests at some stage are on the glacier (Alpinist 1).*

Figure 5.4: Tourists walking on the Tasman Glacier during a flight landing (Photo by Jessica Hughes Hutton)

When asked about the role of glaciers in terms of visitor attraction more specifically, most key informants spoke about them in a positive light. One park manager talked about the novelty of the glaciers, particularly in terms of accessibility:

> *Well they are a very important feature of the Park because there are not many places in the world, I don't think, where the glaciers are accessible like ours. Glaciers are not a feature that is common really around the world (Park manager 2).*

A scientist with a long association with the Park also talked about the shift in glacier tourism over the years:

> *It was a national park that was really well known for glaciers, and people would go to Mount Cook to see them, and that was one of the activities you did, was go and walk on the glacier. And then of course with the way the glaciers changed, it sort of dropped off with the changes to the Ball Hut access. And then all of a sudden, people sort of stopped associating Mount Cook with the glaciers as much when people started focusing on the West Coast in terms of tourism and glaciers. And it's really neat now that with those glaciers retreating, and those glaciers not being as close as they used to and easy to walk on, that suddenly now people have remembered 'oh yes, there's all these glaciers at Mount Cook'. And it's really neat to see that people are doing are now doing glacier tourism at Mount Cook again (Scientist 1).*

5.4.3 Glacier interest among visitors

Of the 400 visitors surveyed, more than half (55.6%, *n*=220) indicated that the opportunity to witness a glacier was important or very important (i.e. selected a score of 5, 6 or 7 on the 7-point scale) in their decision to visit the Park. Similarly, visitors also reported 'the opportunity to get close to a glacier' (55%, *n*=220) and 'seeing a glacial lake with icebergs' (52%, *n*=208) as important, however it was noted by the researcher that many visitors reported not being aware of the glacial lakes and/or icebergs prior to their visit.

When asked about the level of visitor interest in the glaciers, most key informants said that there seemed to be a high level of interest in the Park's glaciers, as well as worldwide, as suggested by the following quote:

> *[Visitors] are definitely interested in glaciers. Glaciers are definitely a drawcard. And I guess at Mount Cook, they'd be secondary to the mountain of course, but they're still a drawcard […] and I think it spurs peoples' imagination to how dynamic our environment is. So I guess glaciers are a less static part of our environment, like the idea that*

> *they're moving and changing is quite interesting for people (Scientist 1).*

Similarly, a park manager talked about his personal experience with visitor interest:

> *They are always asking about it […] you know, say if you were walking up the Hooker and you had your uniform on, people ask you questions about it. The sound of ice falls and rock falls always generate interest, it's all part of that glacial activity that people have an interest in (Park manager 1).*

Visitors were also asked whether they had visited a glacier anywhere else prior to their trip to Aoraki/Mount Cook National Park. The majority (79.5%, *n*=318) said that they had visited a glacier before, most of whom said that they had visited other glaciers in New Zealand (64.6% *n*=206), followed by Europe (50.8%, *n*=162). Unsurprisingly, the most common New Zealand glaciers visited were the Fox Glacier (81.2%, *n*=186), followed very closely by the Franz Josef Glacier (79.7%, *n*=165).

5.4.4 Awareness of glaciers and glacial change

The survey data reveal that most visitors (81.8%) were aware of the glaciers in the Park prior to their visit. More than half (57.5%, *n*=230) said that they recalled seeing at least one glacier during their visit to the Park. It was observed by the researcher, however, that even some visitors who were recruited at the Hooker Valley viewpoint were unaware that they were looking at the Hooker Glacier.

Survey participants were also asked whether they had seen any images of the glacier(s) and/or glacial lake icebergs before they visited to the Park. Slightly more than half (58.5%, *n*=234) reported that they had not seen any images prior to their visit.

All of the 12 key informants were aware of glacial change in the Park, and many had witnessed the change first-hand. Although he did not have a long association with the Park itself, one park manager talked about his experience with the Franz Josef Glacier:

> *You only have to talk to people who can think back to a time when they worked in a place like this, when the glaciers were closer than they are now. It's in peoples' lifetimes that these things are retreating and that's pretty scary when you think about it, that for someone who is nearly 60, they could remember a time when a glacier was miles and miles further down. […] It would be sad day if you couldn't get to see one, which is the risk as time goes on (Park manager 1).*

When key informants were asked whether they thought that the visitors themselves were aware of glacier-related climate change, there was a lot of speculation. Many found that they were unable to answer the question based on the fact that they did not have any first-hand experience with the visitors themselves, and were therefore basing their answer on their own suspicions:

> *I would hope that they are starting to get an appreciation for the change and the fact that we have a lake now is because of climate change, but I wouldn't be convinced of it. It would be good if they were making those connections (Conservation planner).*

Most key informants also made the point that most people visiting the Park are first-time visitors, and therefore had not seen the change in the environment over time:

> *Put it this way, the majority of them wouldn't [perceive change] because most of them are here for, at the most, a two-day experience and it may be the only time that they visit. People who are coming back here, who are regular users, would be well aware of it. That's the difference. Unless we are telling a story, and I'm not sure that we are, and I would think that their exposure to the story is limited. I can't think of how they would be aware of that. That's my view on it anyway (Park manager 1).*

Similarly, a conservation planner said:

> *Of course most visitors to the Park are just one point in time, that frontier mentality […] and they are not seeing what it was like 30 years ago, what changes are happening. That's a problem in my view (Conservation planner).*

One park manager made the comparison between first-time visitors and repeat-visitors:

> *Certainly repeat visitors, like New Zealanders, who came 25 or 30 years ago will say 'oh my God, it has changed'. Or people who used to live in the village and come back up, you know they've been gone 10 years and they're like 'where are the glaciers?', so they remember it and see the change. But if you don't know what you don't know, if you don't know what was there before. We have the pictures in the Centre to try and give a sense of what has happened, as you go down the stairs, that's all about glaciers and the climate. So the pictures are there to try and give that sense of what's happening (Park manager 3).*

Another park manager with more than 40 years' experience in the Park suggested that he did not think visitors would make the connection between climate change and glacial recession:

> *When I'm working up in the Centre and a family comes up and asks where to go, I'm probably one of the few here that will actually try and explain what has happened, what you are going to see when you get out there, because you're going to see these huge walls on the side of the glaciers that didn't used to be there, you're going to see lakes there. I'm not sure if they relate that directly to the change when they're standing on that Tasman Viewpoint. I'm not sure if people really know what they're looking at to be honest. They probably think it's been like that forever, but we know it hasn't (Park manager 2).*

On the other hand, however, a few thought that visitors were aware of glacier-related change, as suggested by a mountain guide of more than 20 years:

> *[…] I think that most visitors are at least aware that there's a question to be asked. Whether they have their own opinion different to mine or different to scientists' opinions, I think they're aware there's a question being asked, for sure […] Will they do anything about it or not? That's up to them. I think most visitors that come here are at least aware there's something going on with the way snow and ice is. (Alpinist 1).*

5.4.5 Backcountry recreationists

Backcountry activities include glacier- and ski-touring, and rock and alpine climbing in the wider surroundings of the Park. All 12 key informants talked of a shift in backcountry activity, particularly a change in climbing patterns. A park manager described the shift by stating that *"climbing has changed because there are not as many climbers around as there used to be [...] climbing is slowly declining as a pastime"*. Similarly, another said that *"climbing as an activity has shifted quite dramatically over decades" (Conservation planner).*

This was reflected in the visitor survey data, as only three respondents reported mountaineering as being their main activity while in the Park, however mountaineers were also one of the more difficult groups to recruit.

One key informant with more than 40 years' experience with the Park also reported that climbers were making *"very short, quite targeted trips as opposed to the longer ones" (Conservation planner)*, resulting in an increase in aircraft activity. He also went on to add:

> *[...] there used to be [...] week-long trips, and people would be going into the mountains and you'd chance your luck on the weather a bit and if the weather was pooey you'd just bivvy out there or just hunker down for a week and you might spend the whole week in the hut just reading books and having cups of tea and not doing bugger all while the storms raged around you. Now people watch that weather forecast. They might be in Auckland and they see a weather opportunity, vroom they fly down, vroom they fly in, knock off the mountain, vroom vroom vroom and they are out. (Conservation planner).*

A mountain guide spoke of his early climbing experiences compared to the people climbing in the Park today:

> *When I first started climbing here twenty years ago, everybody walked in, they carried large packs, and they went for ten-fifteen days to two weeks, and then they walked out at the end and they put in a lot of personal effort to get into remote places. People still want to go to*

> *those places these days, I think it's probably due to the nature of peoples' time constraints and to be honest, fitness, people aren't as fit as they used to be. But time constraints, people want to get the same that fifteen-twenty years ago a person would take two weeks off and go and slog their way to the end of the glacier and spend at least a week in there walking around and exploring. Now they want to be able to go in there, spend the good weather portion there, and exit (Alpinist 1).*

Similarly, a park manager talked about the fact that people today have less time to recreate and more activity options to choose from:

> *We don't have as much time to do the activities that we used to do. Our work patterns are changing, you know, our holidays are becoming tighter, we've got more and more recreation opportunities to choose from, we're competing against all sorts of experiences out there [...]as a society we have less time to devote to some of the activities that we want to do and we've got more competition for those activities. There was a time when you had climbers where that was their main activity. Now they could do a whole range of activities based around their interest, and they've got to actually decide very carefully when they are going to take the opportunity to do something (Park manager 1).*

Most also spoke about accessibility to the mountains becoming increasingly more difficult as the natural environment continues to change, which is also another reason why aircraft use in the Park has amplified:

> *We've got huge issues with people being able to access some places because of the retreat of the glaciers. Increasingly we are finding fewer people are walking into huts because it's so difficult to access them, so air access becomes even more of a motivation (Park manager 3).*

A conservation planner also claimed:

> *Access for climbing has become more difficult, so virtually no one walks in anymore to go climbing, they all fly in. It's just too difficult and too dangerous in part. You know with the glaciers retreating, so the moraine walls, well you end up with huge moraine walls beside the glaciers so getting off those or getting up them is bloody difficult, if not impossible (Conservation planner).*

Many key informants also talked of the huge increase in more front-country-type tourists utilising the Mueller Hut. Of the visitors surveyed, 64 (16%) reported going to the Mueller Hut as a day walk and 22 (5.5%) as a multi-day walk. Any visitor who had already been, or was planning to go, to Mueller Hut during their visit was categorised as a backcountry recreationist, regardless of whether they also utilised other tracks in the Park.

5.4.6 Front-country tourists

According to DOC (2016) estimates, Aoraki/Mount Cook National Park is expected to attract half a million visitors over the next year. All key informants talked about this potential increase in front-country visitors. The Park offers a range of short and easy walks, most of which are to scenic viewing points. When key informants were asked how they think people are experiencing the Park, most talked about the popularity of the walks, as well as the opportunity to experience the mountainous environment:

> *You have lots of freedom people now, coming and just doing short walks but they are really quite confined to that small front part of the Park and Hooker Valley Track (Conservation planner).*

A scientist also talked about the range of activities offered to visitors:

> *I think the cool thing about Mount Cook is that most people go for a walk, whether it's just as short as a little walk around the village, but it is still a walking National Park, I think most people experience the Park by walking. I still think that at the end of the day, regardless of all the tourist activities that are available, you know your boats and your helicopters and your this and that, I think lots of people experience the Park by just going walking, having a look, taking photographs, you know taking photographs of them and the environment, selfies of them with the mountain (Scientist 1).*

Figure 5.5: Tourists walking to the Hooker Valley viewpoint, icebergs in the Hooker Lake (Photo by Jessica Hughes Hutton)

According to the reported activities of the visitors sampled, the Hooker Valley Track was by far the most popular track for walking (62.3%, *n*=249), followed by the Tasman Valley Track (43%, *n*=172) (Figure 5.6).

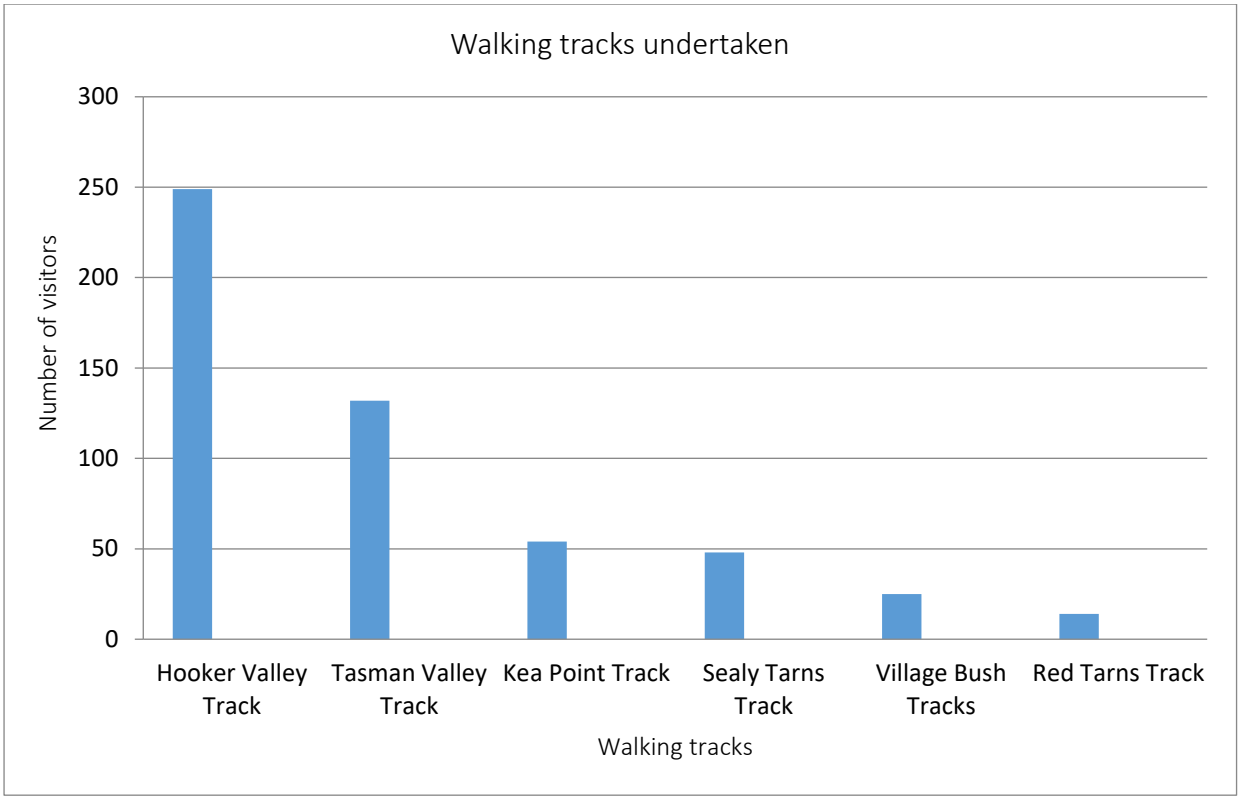


Figure 5.4: Walking tracks undertaken by visitors (*n*=400)

Many also reported the increase in short-stop travellers. One mountain guide talked about his own experience:

> *It used to be that someone would come just for Mount Cook National Park and that was their entire holiday. Now it's a sub-section, they need to get to Fiordland, they need to get to Queenstown, because there's nightclubs in Queenstown, you know, it's a sub-section of their holiday rather than a destination [....] now we are frequently talking to people where we are trying to coordinate whether we can get out in time to get to Christchurch airport or in time to get to Tokyo all in one day (Alpinist 1).*

More than half (59%, *n*=234) of the visitors sampled reported that they were spending one day or less in the Park. Over three-quarters (77.5%, *n*=310) of visitors reported a visit to the visitor centre or Hermitage. Although most of these visitors were also doing some sort of

other activity while in the Park, many were simply stopping in for a short time and not venturing outside the village.

A park manager talked about the idea of people coming to the Park to experience an un-crowded setting:

> *I think people want, even if they are coming from countries that are heavily populated, some kind of experience where there's not too many people [...] I think it's probably the peacefulness and generally it's not densely populated, and that's the kind of experience that they want when they come here [...] even though Hooker can be busy, if you go at the right time, it can be pretty quiet (Park manager 2).*

Of the visitors surveyed, 67 (16.8%) said they were visiting the park alone and more than half (56%, *n*=222) reported that experiencing an un-crowded setting was somewhat important in their decision to visit the Park.

5.4.7 Commercial glacier tourists

In conjunction to the walking tracks, the Park also offers a range of commercial activities including glacier lake tours, scenic flights and heli-hiking, and 4WD and Argo tours. Due to the commercial tourists being the most difficult visitor to recruit, only 19 (4.8%) were surveyed while out on the walking tracks. Nine (2.3%) reported that they had completed a glacier lake boat tour, Five (1.3%) had done a scenic flight, and only four (1%) had done a glacier snow landing or hike.

The increase in commercial flights and heli-hiking was something that was reported frequently by the key informants, particularly in regards to the popularity of the commercial activities among the growing Chinese visitors:

> *I think people who fly in, even if it's just an overflight, and if it involves a landing which is always pretty brief, it's not something you can always do. You know, it's not something that the Chinese can do from the south of China, I mean they don't even see snow so I think that's still a pretty spectacular thing (Conservation planner 1).*
>
> *Certainly with the Chinese, we do have this huge increase in heli-hiking, so that's a growing market of people that are experiencing it in that way. You've still got a lot of flights happening, so a lot of people from above [...] so experiencing it in all those sorts of ways. I don't think that has changed a lot, except the heli-hiking really is changing. Flying in, standing on the glacier, taking your photos for ten minutes, flying back out (Park manager 3).*

The results of this section suggest that there is a relatively high level of interest and awareness around the glaciers among visitors across three identified groups: backcountry recreationists; front-country tourists; and commercial glacier tourists. The interview data also emphasises that all three of these visitor groups have undergone considerable change over time as a result of new markets emerging and others declining.

5.5 Chapter Summary

This chapter presented the results which reflected the first two objectives of the study; the nature of recreation and tourism and the current glacier visitor experience, including findings based on the significance and level of awareness surrounding the glaciers among visitors. The following results chapter, therefore, addresses the remaining study objectives aligning with the overall implications of climate change on the experience of glacier tourism.

Chapter 6

The implications of climate change on the experience of glacier tourism and recreation at Aoraki/Mount Cook National Park

Following a similar structure to that used in the previous chapter, this results section integrates data from both visitor surveys and key informant interviews, reflecting the remaining three study objectives: the implications of climate change on the overall experience of glaciers; the perceptions of climate change among visitors and key informants and the level of awareness around the impacts this may have on resources in the Park; and the extent to which the various key informants have begun responding and adapting to change. Comprising five sections, this chapter highlights the impacts of glacier-related climate change, the current challenges that the Park is experiencing as a result, as well as the anticipated future adaptation and management strategies for park planners.

6.1 Environmental change at Aoraki/Mount Cook National Park

This section presents results drawing on environmental change in the Park from the viewpoints of both visitors and key informants, including how climate change is perceived, as well as the challenges associated with shifts in climatic conditions.

6.1.1 Perceptions of glacier-related climate change

When interview respondents were asked what they thought would happen to the Park's glaciers within the next 20 years, almost all were in agreement that the glaciers were currently

demonstrating rapid recession and likely to continue in that mode for the foreseeable future.

Two park managers, in particular, said that:

> *Well [the glaciers] will clearly go back. There might be a bit of toing and froing, but the trend is definitely going backwards […] that's what the science tends to indicate anyway (Park manager 1).*

In confirmation, another park manager claimed:

> *[The glaciers] will carry on retreating, the lake will get bigger, and the glaciers will downwaste even more. I don't think there's any doubt about it, is there? I'm not a scientist, but I'm pretty sure (Park manager 2).*

A pilot summed up his experience with glacial recession in the years he has spent flying over the glaciers:

> *Certainly in the period we've been flying over the Mount Cook area, particularly the Tasman Lake has expanded immensely and the glaciers have retreated and natural moraines have got much, much higher, so there have been dramatic changes and at the moment it's all one way really (Tour operator 2).*

One respondent also answered this question in conjunction with how glacial recession would impact the overall appearance of the glaciers:

> *Well I think [the glaciers] are almost certainly going to keep on retreating. They are retreating up the valley, but they are also lowering in their surface levels so where that happens, you end up with massive moraine walls and once they collapse it all becomes a very uninviting place to be (Conservation planner).*

When asked the same question, the majority of survey respondents (69.8%, *n*=279) indicated that glaciers would recede significantly, while 9.5 per cent (*n*=38) thought they would recede slightly and 9 per cent (*n*=36) believed they would disappear entirely. No one thought the glaciers would remain the same, and 10.3 per cent (*n*=41) were unsure.

An alpinist also talked about what the mountain landscape would look like if the glaciers were to disappear entirely:

> *Frankly, Mount Cook without glaciers is pretty ugly. These mountains when they're denuded of snow are pretty ugly when you see the bare bones of the land, so it's quite sad really (Alpinist 2).*

The same respondent went on to relate this to how climbing has changed in the Park over time, as well as his predictions in relation to glacier recreation in the future:

> *Being an old fart, when I was here in the 1980s we could go ice climbing on the Mueller Glacier near the swing bridge and the Tasman Glacier had three small sinkholes […] We're not going to be able to ski the Tasman, there's a lot of things we're not going to be able to do. You don't want to be on these mountains if they're not covered in snow, they're just troughs. So it's going to have an enormous affect and it's going to be quite different quite soon, that's my interpretation (Alpinist 2).*

Another alpinist illustrated his experience with glacial recession by comparing it with how his children are experiencing the same glaciers today:

> *I took my kids on top of the glacier during the last school holidays and it's really interesting showing them this change […] I can't see a reversal in it. I am going to be quite emotional when I take my children up and show them the glaciers and wonder if their kids will see the same stuff, because it's definitely different to when I came here twenty years ago (Alpinist 1).*

Similarly, another respondent spoke of her childhood memories of what the glaciers used to look like:

> *Even as I went there as a kid, I can remember that's the thing that we did, we walked in and looked at the Tasman Glacier and it was like 'this is glacier'. I mean those are the glaciers that I grew up with; the big, debris covered glaciers and to me that was the glacier (Scientist 1).*

Only one respondent mentioned the issues that some of the smaller tourism operations are experiencing as a result of glacial recession:

> *For the 4WD and Argo tours, their main issue is that the moraine wall keeps crumbling and so they can still get access up, but they've got to keep moving back because their viewpoints keep falling into the glacier. Plus where the snout of the glacier is, they used to look down to it, now it is way in the distance because it's retreating back (Park manager 3).*

In contrast, a few respondents showed some uncertainty around *"what climate change is actually going to do for high-alpine snow" (Conservation planner).* For example, one tour operator with more than 40 years' association with the Park seemed unclear about the causes of climate change:

> *I guess only history will show us if this is more cyclical than brought about by human intervention […], if it's a downward slide or just a cyclical thing. I know the evidence for global warming is pretty compelling, but then when you look back through the millions of years there have been many events like this that have been severe too, long before humans had an influence (Tour operator 3).*

In addition, another respondent with many years' experience in geology and glaciology spoke quite optimistically about the long-term future of the glaciers:

> *[…] Things could actually start stabilising, depending on what our climate keeps doing […] Yes, definitely in the next twenty years, we'll continually see them getting smaller, but in that time there may be pauses where they're not necessarily going to retract way up into the mountains and disappear completely […] So as the lakes expand, the bed slope gets higher and higher as you get up to the mountains and eventually the glacier detaches from the lake, and once it gets to there, it can stabilise again. So it might be further away, but you might get into a situation where they're accessible again, just in a different sort of way […] In twenty years' time, the Tasman Glacier will still have a really good tongue of ice, so you'll still definitely be able to heli-hike on it and things like that for sure (Scientist 1).*

Another common theme among interview respondents was the rapid growth of the glacial lakes. Many of the participants who had a long association with the Park commented on how they had witnessed the growth first-hand over the years and most predict the lakes to continue growing into the foreseeable future. One alpinist summed this up by saying *"I've*

seen in aerial photos there was no lake at all around 1983, and now we have a lake that is 5-10 kilometres long" (Alpinist 2). Another alpinist also said:

> *The glacier lakes are going to expand dramatically. When I first came down here, the Tasman Glacier Lake was the size of a couple of decent sized swimming pools. It's now pretty close to four kilometres long (Alpinist 1).*

Many respondents also made reference to the smaller hanging glaciers[3] in the Park, and emphasised that the big valley glaciers are not the only glaciers experiencing rapid retreat. In fact, most were very concerned about the future of the hanging glaciers, particularly the Stocking Stream Glacier, as one alpinist illustrated:

> *A lot of the smaller glaciers are just going to disappear, they are going to turn into remnant snowfields. Stocking Stream Glacier used to look like the shape of Italy with the boot at the bottom, but if you actually go and look now, it looks like someone has amputated the leg above the thigh; it's a stub […] Back in photos you see in the 1920s, none of that's there. It's just a bit of remnant there at the top now (Alpinist 1).*

A park manager also supported this by saying that *"Stocking Stream Glacier is probably a quarter of the size it was when I arrived. Every year it just gets higher and higher" (Park manager 3).*

On the other hand, one scientist spoke of the hanging glaciers a bit more optimistically:

> *And all the other wee hundreds of glaciers, because they're so small they react to shorter-term climate changes, so although we see some of them maybe get a bit smaller and we might see more ice topples as they retract over to bedrock, but if we have some years where it's cooler and snowier, they could potentially advance and retreat, advance and retreat just slightly like they have been doing for quite a few years […] So you may not find that they look that much different than they do today. They might be slightly shorter, but they'll potentially still be there (Scientist 1).*

[3] A glacier located high on the wall of a glacier valley which descends only part of the way to the surface of the main glacier (Salinger et al., 2008)

Furthermore, respondents in the visitor survey were asked a set of four questions which measured their opinions about the existence, causes, and level of concern about climate change. All questions were measured on a 7-point Likert-type scale.

Among visitors, awareness of climate change was also very apparent, with over three quarters (78.8%, *n*=315) of respondents 'completely agreeing' with the statement that climate change is occurring right now. No respondents 'completely disagreed' with the statement (Figure 6.1).

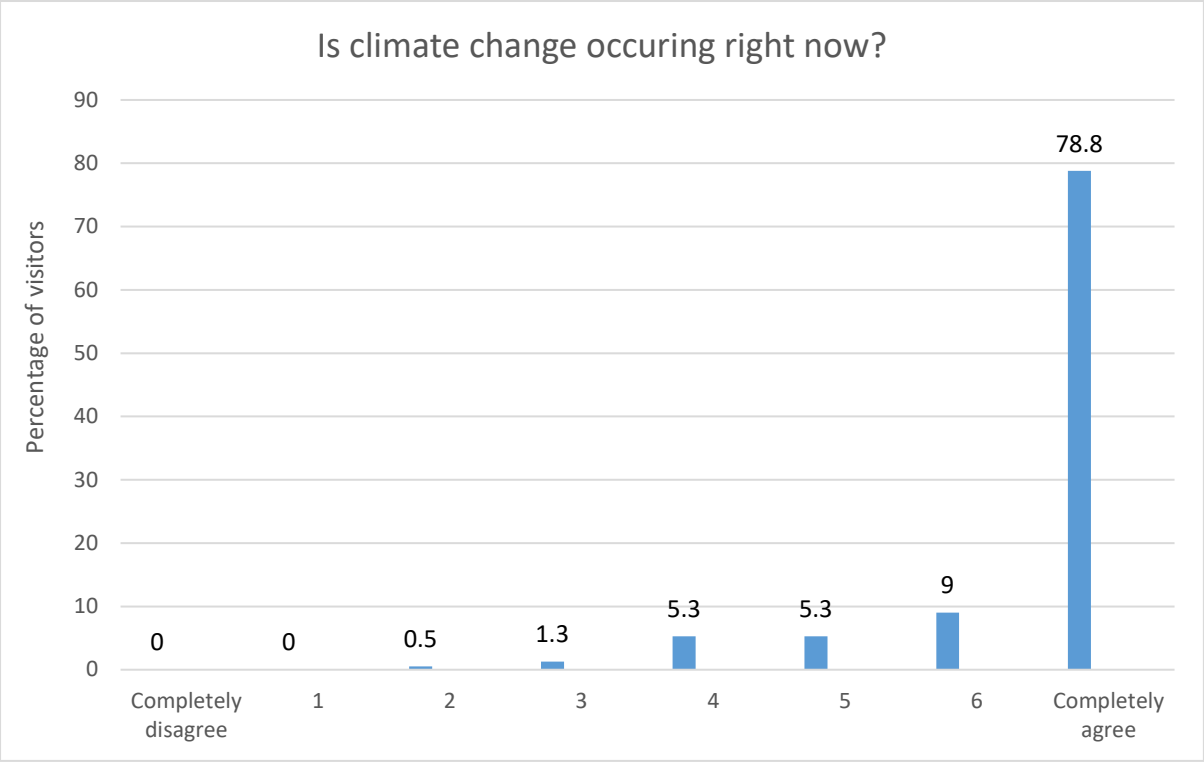


Figure 6.1: Is climate change occurring right now? (*n*=400)

The 230 survey participants (57.5%) who reported seeing at least one glacier during their visit to the Park (previous chapter) were asked to indicate their expectations and satisfaction with experiencing one of the glaciers. The questions focused on three aspects of the glacier

experience using a 7-point Likert-type scale: the 'glacier size', the 'appearance of the ice', and 'how spectacular the glacier was overall'. A 'not sure' choice was a possible option for each expectation question, but only those who indicated a 1-7 on the scale were included in the analysis (see appendix for full copy of survey).

Well under half (38.7%, *n*=89) reported that the glacier was as big as they had expected by selecting a score above the centre point of '4' on the scale. In addition 37 per cent (*n*=85) indicated it was the size that they had expected, and the remainder (13.9%, *n*=33) expected the glacier to be smaller than it was. Ten percent (*n*=23) of respondents reported that they had no expectations in regard to the size of the glacier. Despite the expectation of a larger glacier, however, satisfaction was still high and over half (56.2%, *n*=129) of respondents reported being somewhat satisfied (i.e. scored a 5,6 or 7 on the 7-point scale) with the glacier size, with 25.7 per cent of respondents giving the highest score of 7. Only 4.3 per cent (*n*=10) of respondents reported being dissatisfied with the size of the glacier.

Over one third of respondents (37%, n=85) reported that the glacier ice was how they had expected it to be, while exactly half (50%, *n*=115) expected that the ice would be cleaner, 7.4 per cent (*n*=17) thought it would be dirtier, and 13 respondents reported that they were unsure what the ice would be like. In addition, 20 per cent of respondents (*n*=46) were very satisfied with the visual appearance of the glacier ice, and just over half (50.5%, *n*=116) scored satisfaction above the centre point of the scale. Only 27.4 per cent (*n*=63) reported being dissatisfied with the appearance of the ice.

A little under half of all respondents (43.5%, *n*=100) reported that the overall look of the glacier was as spectacular as they had expected, 35.2 per cent (*n*=81) expected it to be more spectacular, and only 16.9 per cent (*n*=39) expected it to be less spectacular. The remaining

10 respondents did not know what to expect. Satisfaction with the overall glacier experience was reasonably high with 26.5 per cent (*n*=61) reporting that they were very satisfied with how spectacular the glacier was overall by scoring a 7. Altogether, 67 per cent of respondents (*n*=154) scored satisfaction above the centre point of the scale. Only 18.7 per cent (*n*=43) of respondents reported being dissatisfied by scoring below the centre point of the scale.

Overall, not surprisingly satisfaction was highest for those who had expected a smaller glacier, dirtier ice, or a less spectacular glacier. Furthermore, satisfaction was lowest for those who had expected a bigger glacier, cleaner ice, or a more spectacular glacier.

Conversely, many of the interviewees talked about glacial recession in relation to the expectations of visitors to the Park. Two respondents even compared the Aoraki glaciers to those on the West Coast:

> *I suspect there might be a bit of what is happening to the glaciers over on the other side, in that people have an expectation that they are going to be able to see or get to touch lots of ice and things like that, and that is becoming less and less of a reality […] (Conservation planner).*
>
> *I think [visitors'] expectations are not met because they think that our glaciers are like the Fox and Franz which are completely white to the very end, whereas we have a whole range of glaciers from wall glaciers, to hanging glaciers, to valley glaciers […] I know people are disappointed, especially with the Tasman (Park manager 2).*

Another respondent also talked about the appearance of glaciers elsewhere in the world and how it might skew visitors' expectations of the glaciers in the Park:

> *Obviously a lot of people come to see a glacier, and I suspect they are a bit disappointed because it's not like what they see on TV, say like in Canada or Patagonia where you've got a glacier rushing into the sea and it's all white and pristine, and then they see our moraine covered gravel heaps (Alpinist 2).*

Similarly, a scientist added that *"people see a lot of material on the internet and so they have in their mind what they think it's going to look like" (Scientist 1).* However, of the 166 respondents (41.5%) who indicated that they had seen images of the glacier(s) and/or glacial lake icebergs prior to their visit to the Park (previous chapter), over half (59.3%, *n*=51) thought that the images accurately portrayed the current condition of the glacier(s). Only 29.1 per cent (*n*=25) thought the images were inaccurate.

Conversely, an operator involved in a flight operation was able to discuss first-hand about the issues that they have experienced as a result of changing snow conditions:

> *There's been quite a bit of adjusting in the summertime with no snow when we're having these extreme droughts. You know, running out of snow and they're advertising that they do snow landings, so there's been a bit of change around that sort of thing […] they have to make sure they're selling the product that they've advertised (Tour operator 1).*

When asked if they thought climate change was a result of natural causes, 13.3 per cent (*n*=53) 'completely agreed' that climate change was a result of natural causes, a relatively similar percentage (11.8%, *n*=47) 'completely disagreed', and 19.5% (*n*=78) indicated a neutral opinion by scoring the statement with a 4 on the scale (Figure 6.2).

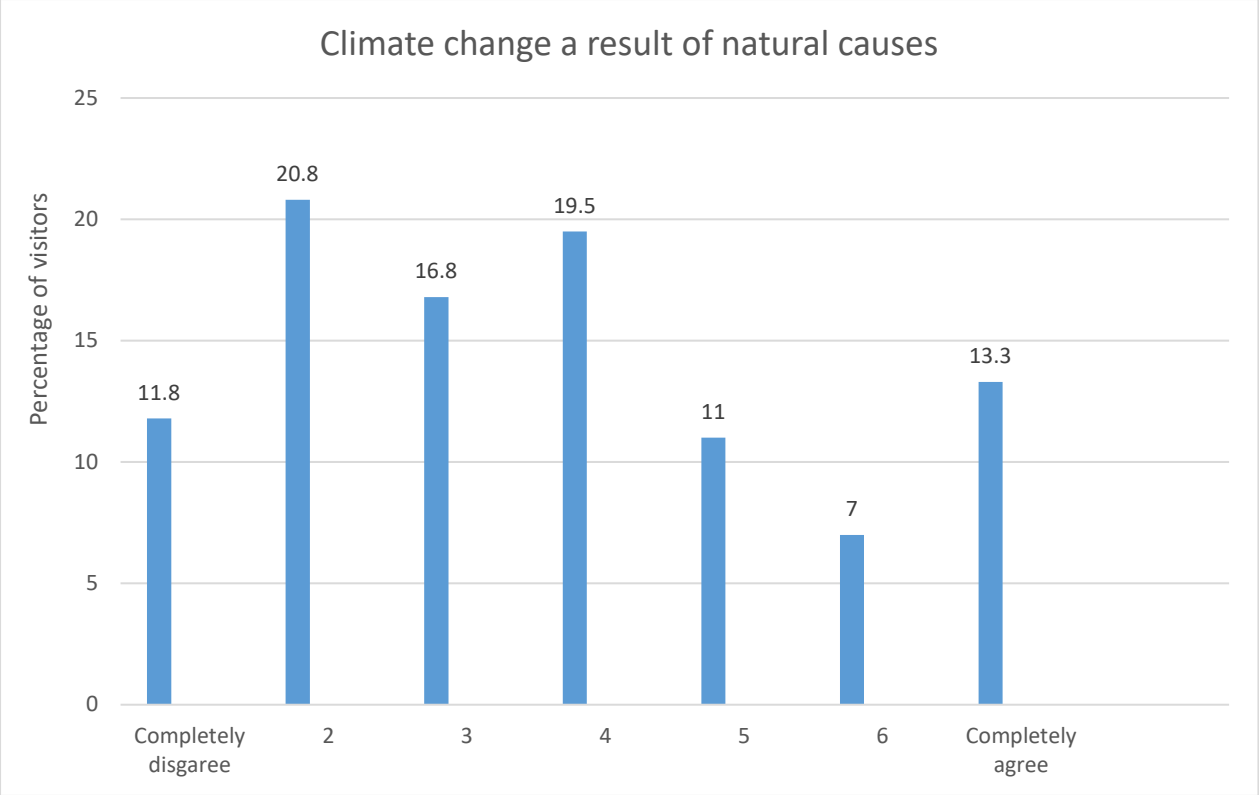


Figure 6.2: Climate change as a result of natural causes (*n*=400)

There was a much higher level of agreement with the statement that climate change was a result of human activity, with almost half of all respondents (46.3%, *n*=185) 'completely agreeing', and only 13.3 per cent (*n*=54) being either neutral or disagreeing (Figure 6.3).

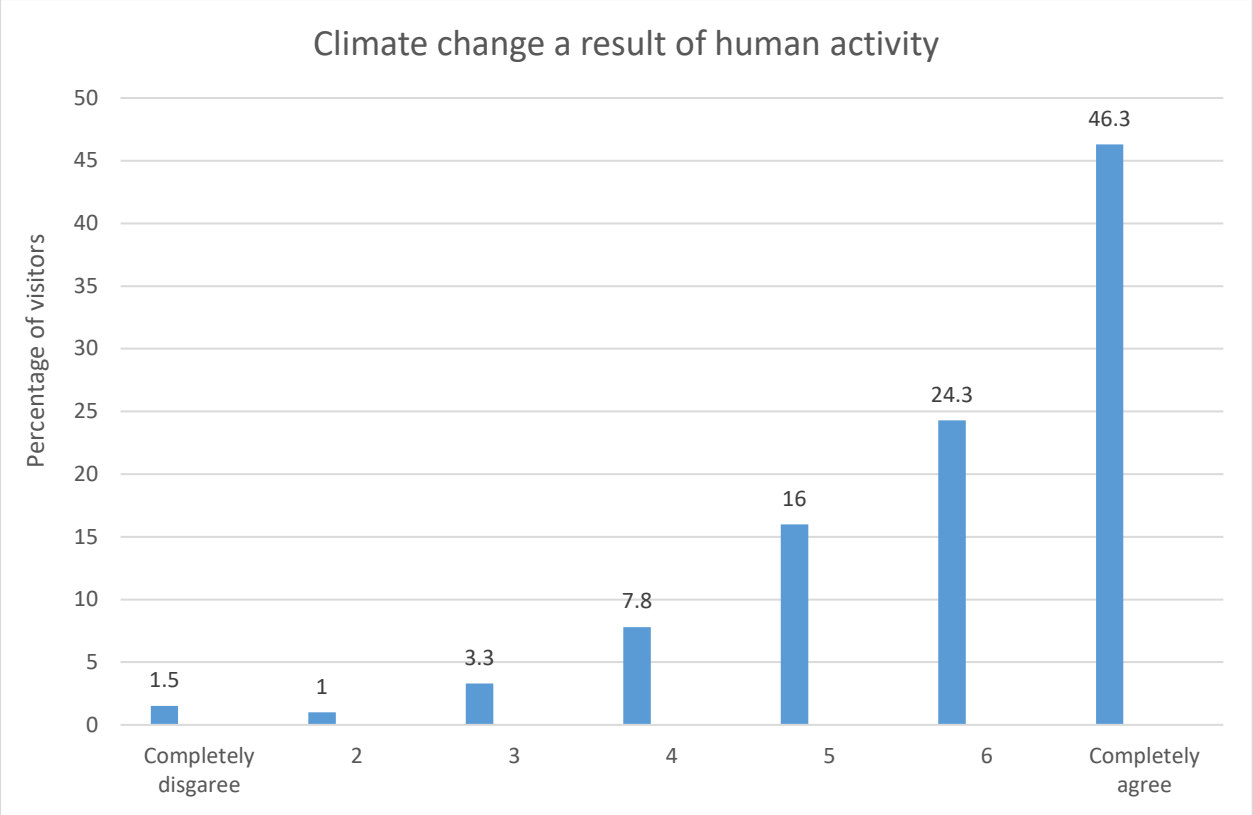


Figure 6.3: Climate change as a result of human activity (*n*=400)

The majority of respondents (68%, *n*=272) reported that they 'completely agreed' with the statement that climate change was very concerning, while only 3.9 per cent (*n*=15) reported no concern (Figure 6.4).

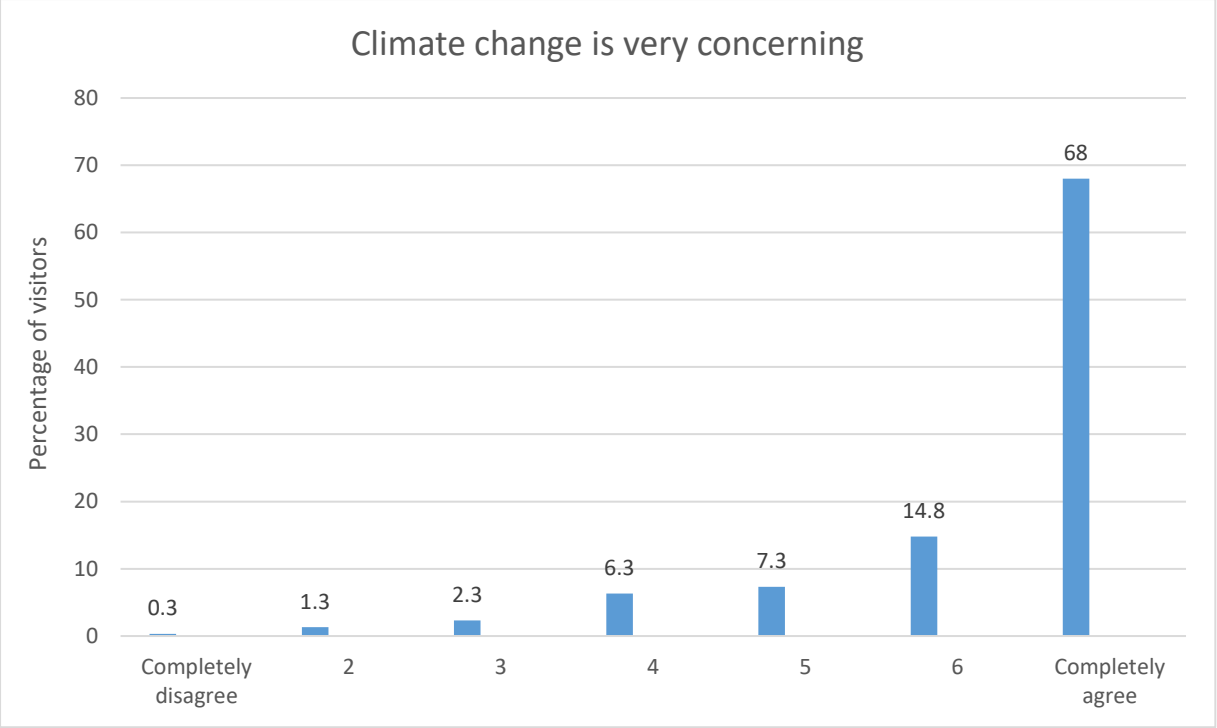


Figure 6.4: Concern about climate change (*n*=400)

6.1.2 Perspectives on climate patterns

A small number of key informants talked about climate change in a much broader sense, particularly in regard to catastrophic events occurring as a result of the changing environment. For example, a conservation planner commented on the potential for a *"tsunami-type effect*" if mountains were to slide into the glacier lakes.

Similarly, the same respondent discussed the ways in which *"virtually every aspect of DOC is being affected by climate change" (Conservation planner)*. He also went on to add:

> *Biodiversity, recreation, the whole caboodle, concessions, what people are doing, and everything else. It's a massive change and it's happening right across the mountains. Fires, threats, the whole bloody works. It's all changing, frighteningly so (Conservation planner).*

Another respondent with over 30 years' experience with the Park also talked about the increase of *"extreme"* weather events:

> *I have been thinking about it and climate change doesn't necessarily mean it's going to get warmer, it just means extreme. Here, my perception is that it's just extreme weather, so extreme drought or extreme snow or extreme rain or extreme wind (Tour operator 1).*

However, she also made a comparison with extreme weather events that occurred back in the 1980s:

> *When I first came here in 1980, we had huge floods and bridges washed out and roads covered debris in and the Tasman Delta was bank-to-bank with water and Mount Cook was getting rainfall at the rate of eight inches an hour, so this was back before people were really talking about global warming and the changes. I remember a December probably about 31 years ago where every single day it rained and we had flooding through Christmas and New Year (Tour operator 1).*

6.1.3 Reduced snowfall

The issue of reduced snowfall was also a common theme among interviewees. One respondent highlighted this by telling a story of how he used to go tramping in the summer over passes with permanent snow and compared it to the conditions today:

> *Back in 1971, a group of us tramped from Arthur's Pass to Mount Cook. So that was 18 days walking over a hot summer. Every single pass back then had permanent snow on it. And as for the Tasman Glacier, we were able to walk in summer on snow virtually the whole way down to Ball Hut. So that just puts it into perspective, you know, people today are never ever going to experience that. It's just so different. It's mind blowing (Conservation planner).*

The issue of accessibility was another key theme that emerged from the interview data, particularly in relation to high-alpine recreation in the Park. One respondent said that *"it is going to be more difficult for people to get to the high huts and the high areas of the Park for skiing and climbing" (Conservation planner)* as a result of difficulties in accessing these areas.

In conjunction with accessibility, respondents also talked about the safety issues associated with changing snow and ice conditions. An alpinist talked of his experience:

> *As a recreational climber and professional climber, there's going to be a lot of shorter seasons where we just cannot get onto ice. We had a phenomenally good season this year in terms of being able to get through glacier access ways because we had such a terrible weather season in the early summer so the glaciers stayed filled up with snow, but as soon as the weather got warm, the overall effect is downwasting […] And the bigger glaciers are going to be harder to get on, harder to get off, lower, and access ways on and off are going to start becoming quite dangerous (Alpinist 1).*

The Copland Pass was often brought up by respondents as a *"classic example" (Tour operator 3)* for highlighting the ways in which access has changed the ways these high-alpine areas are used:

> *I guess a good example of the [change in recreation] is the Copland because the Copland Crossing was done regularly for maybe a hundred years and then it changed dramatically because of glacier downwasting and downsizing of the valley walls and we couldn't access it, and that meant a change of people doing Ball Pass Crossing instead of the Copland (Park manager 2).*

Access was also often discussed alongside the increase in helicopter use, whereby more climbers are flying into the higher areas as a result of accessibility becoming too difficult and dangerous to walk in. One alpinist spoke of a connection between aircraft use and climate change:

> *One of the things that has changed because these glaciers have receded; access has got way more difficult which is a result of people flying in and out a lot more than ever happened in the previous decades, and I think it's going to get worse (Alpinist 2).*

Many also talked about the difficulties that ski planes are experiencing as a result of requiring snow in order to make landings. One respondent summed this up:

> *Of course you can only land if you've got snow, and they used to have something like 15 landing sites that they used to use and they are now*

> *down to, on their concession, about half a dozen and sometimes they struggle to find snow on one of those to land, so it's becoming less and less viable as an operation (Conservation planner).*

The same respondent also talked about the impact this has had on flight operations:

> *I think the tourist industry for a long time has been selling this idea of snow landing, landing by aircraft on snow and they have been really pushing this. I think they are going to have to change their reviews on that because we are running out of snow (Conservation planner).*

Similarly, a pilot also illustrated the issues with snow landings:

> *Landing options have been severely limited at times because of the warmer years. It has perhaps effected our helicopter operation a little bit that the window of landing on snow away from the glaciers has got narrower as snow has disappeared more quickly and earlier (Tour operator 3).*

One respondent also made a connection between the issues with ski planes and the increase in helicopter use within the Park:

> *Now it's predominantly helicopters, gets you into more places, more reliable with the weather that's available. Ski planes, as much as I love them, have a lot more constraints on where they can land and when they can land and what weather they can land in (Alpinist 1).*

6.2 Climate-related challenges at Aoraki/Mount Cook National Park

This section presents results based on the two major climate-related challenges that are currently being experienced at the Park according to the key informant interviews; the pressure on infrastructure; and the increase in helicopter activity.

6.2.1 Infrastructure pressure

A key issue that was addressed by many of the interview respondents was the removal of a number of backcountry huts as a result of avalanche risk. One park manager made it clear that this was a key management issue within DOC:

> *In the five years that I have been here, we have lost Gardiner Hut, we have had to pull out Hooker Hut because it was under threat, we have got other issues around huts that are under pressure, we have a number of reasonably large rock falls. They are all indicating that the condition of the area seems to be changing, which puts pressure on how we manage some of the existing assets within the Park (Park manager 1).*

An alpinist also talked of the hut removal as a way of illustrating the changing climate:

> *The ground that [our huts] are on is becoming unstable and they have to be shifted or removed or remediated. Mueller Hut for example, there's big openings in the ground up near there and that's being monitored because it's unstable. And we've lost quite a few of the alpine huts like De la Beche from unstable rock where it was on the moraine wall, Beetham Hut was removed by an avalanche, Gardiner Hut was removed by an avalanche, Hooker Hut became inaccessible. And a lot of these were often sort of halfway huts, so they had a safety role too (Alpinist 2).*

Another respondent with a long history of climbing in the Park also spoke about the importance of the backcountry huts and expressed her disagreement with some aspects of how they have been managed:

> *Our high-alpine infrastructure is degrading and the approach to that has just been to remove, remove, remove, and I actually think that's quite disappointing from a climbers' perspective […] because I guess the thing is that yes, some of the access to the mountain huts has got tricky with glacial retreat, but I sometimes think management has too short a view on the use of some of the high-alpine infrastructure. A lot of it has just been taken out because it's expensive to maintain […] I guess we're in an impasse of funding available to maintain infrastructure and so it comes down to a spreadsheet, it comes down to where are the most people, what are the most people using, let's put our money into that, and then the alpine hut that's been sitting there for years and years and years and is actually still okay but it's*

just not being used much, they think maybe we should get rid of that, which is a bit of a shame (Scientist 1).

6.2.2 Helicopter activity

In light of the changing climate, the increase in helicopter activity in order to access the glaciers and backcountry areas, and the consequent allowance of more flight and landing permits in the Park, was another issue that many interview respondents discussed. One respondent said:

> *Well it's already happening; they're allowing more flights, more helicopter landings […] Times change, once Franz and Fox were only using helicopters, suddenly we're allowed to land helicopters on Tasman Glacier. And at the moment they're loosening the scope, in fact I don't even know if they've got numbers a day limits set there yet, which I think they'll probably have to start thinking about because I think they'll have to start looking at what they've been doing on the West Coast and how the West Coast are dealing with more people wanting to do that kind of thing. And with the loss of walking access, more people want to use helicopters. And there will be more flights, there will be more landing areas, and that will probably need to be managed in some way (Scientist 1).*

As many respondents highlighted, along with the increase of aircraft use comes the issue of noise. One respondent who was heavily involved in the national park management plan talked of the current flight concessions in the Park already being at a high number:

> *The aircraft landing numbers that we had when we did the current plan, which were somewhere between 3,500 and 5,000 a year, was the point at which we were starting to hit that annoyance level trigger that the Department works with (Conservation planner).*

It was obvious that many respondents felt conflicted with the increase in flights and the consequent impacts on the environment. One pilot gave his opinion on the issue:

> *Of course we're all burning fuel and [aircraft] create a lot more noise than normal. So you get a lot of climbers and recreational walkers that get bothered by the noise, but at the same time they use our services.*

The climbers are always getting us to fly them in and three days later, rescue them […] the only thing that I can think of is to stop flying altogether and burning less fuel, which is probably slightly negligible at this stage (Tour operator 2).

Figure 6.5: Mountaineers preparing to fly
(Photo by Jessica Hughes Hutton)

Another respondent suggested that he would like to see visitors choosing to undertake activities in the Park that do not involve flying:

I think it would be nice if we had people easing back a bit and saying 'well I don't want to be part of that noise generating and I'll choose my tourist activities wisely, I'll go for a quiet boat on the lake, or I'll just go walking, or I'll just stand and look. I don't have to fly in everywhere, I don't have to land' (Conservation planner).

Another also talked about the potential for allowing air access in the Hooker Valley in order for backcountry recreationists to access more areas:

We might allow aircraft where we haven't before for climber access. So there's quite a lot of debate going on at the moment around climbers accessing Hooker Valley by aircraft because they've not been

> *able to do that up until now, now that we've a lost a hut because of climate change (Park manager 2).*

Similarly, another key informant said:

> *I think that's definitely something we'll see, more aircraft usage getting into the mountains. An interesting question will be whether we see them opening up the helicopter access in the Hooker Valley because in the past there was always a bit of a gentlemen's agreement that they weren't going to have aircraft activity in the Hooker Valley. It was never actually written as a rule, it was just an agreement by everybody that used to work there that Hooker Valley is the walking valley, Tasman Valley is the one where you can fly in and out [...] So maybe we're going to start seeing flights into the Hooker Valley as well, that would be interesting (Scientist 1).*

Another park manager talked about the opening up of new landing zones further down the glacier to allow more visitors the opportunity to continue viewing the glacier as it retreats further back:

> *So the implications for planning is the air access, landing sites and landing zones, and whether we open up more landing zones further down the glacier so that you can fly. There's some lovely little sites out on the glacier there where you fly up there and do a bit of a walk round and view it. And for climbing and recreation, same thing […] So air access is the key to still using the glaciers (Park manager 3).*

6.3 Visitor and key informant adaptation to glacier-related climate change at Aoraki/Mount Cook National Park

This section presents results based on visitor and key informant adaptation strategies, including the ways in which recreation and tourism patterns have changed, the increase of guided operations in the Park, and the current use of education and interpretation.

6.3.1 Changing recreation and tourism patterns

As tourist numbers continue to grow, it is becoming clear that, compared to past years, there is no longer an off-season in the Park, as suggested by one park manager below:

> *In days of old, everybody came over Christmas and January, it was just full on, and then it sort of petered out and in winter it just died. I used to do the visitor centre numbers and they'd half each month, and in winter in those days you might get a hundred people through in July. And now there's barely a shoulder season and winter is still quite busy (Park manager 3).*

The idea that spatial boundaries of front-country tourists were changing in the Park was a common point of discussion among interview respondents. For example, one respondent suggested that visitors are not limited to the front-country areas like they used to be by saying that *"we are starting to see more people flying into some of the other huts and doing overnighters there who aren't climbers or skiers" (Conservation planner 1).*

Another respondent believed that many visitors were going to the Park with an expectation that the backcountry areas were easily accessible without any experience as a result of the booking system that exists:

> *Many of the visitors here, especially the young visitors, they just want to go and stay in a hut and are so locked into the booking systems, and that creates the expectation that 'oh if there's a booking system then I should be able to go and stay in that hut' without realising that their ability to actually get to that hut is completely different. And so many people come here thinking it's like the access opportunities that exist elsewhere, when in fact it's not (Park manager 1).*

6.3.2 Increased commercial guiding operations

One commercial activity that has emerged in the Park as a result of glacial recession is the boat tours that take place on the pro-glacial lakes. Most respondents were in agreement that

the lake tours had been incredibly popular among visitors, and one respondent in particular talked very highly of the operation:

> *The big drawcard now will be to go boating on Tasman Lake, which is a very recent thing and it's a stunning experience. It's well worth doing in terms of looking at how you can make use of a new thing, a new lake and how you can do really good interpretation and how you can do it well. I think they are doing quite a good job there (Conservation planner).*

In contrast, another respondent referred to the operation as *"bums on seats and that's about it" (Park manager 2).*

Others also made comments around the difficulties that the boat tours are already experiencing as a result of the glacier being further away or the lack of icebergs on the lake:

> *[The boat tours] are struggling with the lake getting bigger and bigger and bigger and not as much ice in the lake, so when they have a big carving, there aren't as many icebergs as the glacier retreats back (Park manager 2).*

A park manager suggested a potential solution for this issue:

> *I guess they'll just have to spend longer getting to the snout. It might be that we need to alter some of the landing sites so that they can fly and then hop on the boat because access becomes more and more difficult (Park manager 3).*

In addition, another respondent talked about the future of the boat tours in terms of visitors' expectations:

> *It's going to be interesting as the glaciers get less impressive because the thing is, as those lakes get bigger and warmer, the icebergs don't last in the water as long. So in terms of what people are turning up expecting to see, it's getting potentially more boring. You can imagine with Hooker Lake, if that lake goes further away and the terminus is way up the far end and there's not much ice in the lake, [visitors] are not necessarily going to be as attractive (Scientist 1).*

She also went on to add that the boat tour operation has already had to make modifications as a result of the changes to the lake:

> *They've already shifted to more powerful boats that go faster so that they can actually get down to the terminus. They've modified their trips to deal with that and they'll continue to do that no doubt to a certain point (Scientist 1).*

While this informant noted the popularity of the lake tours, as a result of the difficulties in recruiting visitors as part of a guided tour group, only 2.3% (*n*=9) of the survey participants indicated that they had taken part in a glacier lake boat tour.

Heli-hiking was another activity that respondents suggested was growing in popularity. One park manager said that *"the heli-hiking will continue to go from strength to strength".* Notwithstanding the reported popularity of heli-hiking, however, this was not reflected in the survey data with no respondents reporting that they had, or intended to, undertake heli-hiking during their visit to the Park.

6.3.3 Education and interpretation

Of the 400 survey participants, just over half (50.6%, *n*=202) indicated that the opportunity to learn about the impacts of climate change on the glaciers was an important factor in their decision to visit the Park.

Most respondents talked of the need for education and interpretation around climate change to become more of a priority in the Park. One respondent suggested that the opportunity to learn about these issues had become part of the attraction for visitors:

> *I think things like the lake tourism and with the visitor centre, people are starting to hook into the whole natural history tourism […]*

> *[visitors] are not just going there to see, they are actually going there to learn something. And when you give them some good interpretation stuff, explain to them what is going on in the place, it all becomes a pretty attractive package (Conservation planner).*

An alpinist also emphasised DOC's role in educating young people about climate-related issues in the Park, and credited this to the redevelopment of the visitor centre as an educational tool for providing visitors with context around the changes that have occurred over the years:

> *We have educational groups that come here to learn about the geology, to learn about the glaciation. There's quite an active educational bend to the Department of Conservation here. Almost every day there'll be school groups going walking in the bush and learning about what a moraine wall is […] particularly they can go to the visitor centre and look at the old photos and then go and look out the window and go 'where'd that go?'. That visitor centre is an amazing asset (Alpinist 2).*

The same respondent also talked about education in association with his own role as an alpine guide. He spoke of his confliction between his love for the mountain environment and his own impact on it as a result of the nature of his job:

> *I can see our adventures becoming shorter, less strenuous and more mechanised, which completely flies in the face of what we as a human kind ought to be doing to stop the issue, or at least slow down or semi-reverse the issue. That's the way I see the commercial side going. What we should be doing is encouraging everyone to walk everywhere, but no one wants to. In an ideal world, we would still have good access ways. And we are as guilty as everyone else in promoting the easier options because that's what will keep us employed, keep the Park busy, and keep visitors. And we get a benefit by educating them, by getting them to see it, but we are using a huge carbon footprint to get them in there to do that. We're doomed, we're doomed (Alpinist 1).*

6.4 The future of glacier recreation and tourism at Aoraki/Mount Cook National Park

This final section documents participants' perspectives on the future of the Park during a time of rapid change, including potential management strategies for park planners, the expected growth in tourist numbers, and appropriate adaptation methods.

6.4.1 Management and planning

There was a lot of discussion around the management strategies that need to be put in place in the Park in order to adapt to climatic change. Many had suggestions for what needs to happen, but it was also acknowledged that some strategies are incredibly difficult to actually put into practice. One park manager asked some broad management questions:

> *How do we provide for access and how do we provide for people's expectations around future use of this place? Do we provide more, as in put more facilities into it? Do we expand the village to cater for tourism growth or do we keep it as is? How do we respond to visitor growth for this place and how do we manage it? (Park manager 1).*

He also talked about the management of the glaciers themselves:

> *We are going to have to be quite adaptive in our management of those things. One, to deal with the numbers and two, to deal with availability of access to a resource that may be shrinking in time. And how do you get that balance right? If you think about a large percentage of the market wanting to fly and land and you've only got so many options around that, then you are going to have to think really carefully about how you're going to do that in the future. And that's about how you allocate an increasingly scarce resource (Park manager 1).*

One scientist spoke very passionately about the need for better management strategies in order to protect the Park's natural resources:

> *DOC in the past hasn't necessarily reacted or responded to tourism in a way that it is going to have to. And so I think things are moving in a good way, I think there's a lot more pro-action, people being more*

> *proactive about management. But I still think we've got this challenge where in the past DOC has been very standoffish and telling you that you shouldn't do this and you shouldn't do that, but the minute you walk out the door you can do what you like and be where you like […] I think we need to move towards more management and more enforcement. I want to look after my Park. I don't want to shut it off, but I just don't want it to get too degraded so I can still go for a walk and not have to see stuff I don't want to see (Scientist 1).*

Many respondents also made reference to the current review of the Management Plan, particularly around the management strategies that will need to be put in place within the Park in the foreseeable future. One respondent in particular eluded to his role being highly dependent on the outcome of the review:

> *It's all to do with the Management Plan Review, isn't it? [...] So I think we will have to be more flexible in the future and I think the Plan has got to give us at an operational level to do stuff which the current Plan hasn't been able to do (Park manager 2).*

One respondent had made a number of submissions to the review and used her professional role in order to inform decision-making processes *"because you can't complain about a plan when you haven't had any input (Scientist 1).* She also went on to add:

> *We really should be trying to communicate our sciences in such a way that it can be useful for these kind of decisions where relevant. I think we need to improve a lot in terms of thinking about engagement with this kind of management side as well (Scientist 1).*

Another park manager talked about the focus on accessibility within the plan review:

> *Now we are going through the Park's Plan review and some of the thinking, based on my experience of managing this, is around where do we go in the future about providing an opportunity for people to see these things that are diminishing and we are seeing more and more pressure on peoples' desire to access these things, and it's going to become harder and harder as that resource disappears […] We have to be sure that in the future we manage that accessibility in a way that it's not over used, there's a good balance there. That's the challenge for the future (Park manager 1).*

Air access was another common theme among interview respondents when asked about the future management of the Park, as one park manager suggests:

> *Do we provide more air access within the Park? Clearly there is an appetite for it amongst tourists, but where do we set the limits on these things? It's about what are the acceptable limits and what is sustainable over time. They are the big, big questions that aren't necessarily the easy things to answer (Park manager 1).*

6.4.2 Tourism growth

When asked if they think people will still visit the Park if the environment continues to change, the majority of key informants thought they would, for example one respondent said:

> *They will [continue to visit] because I don't think the mountains will actually fall down. They might change a bit, like Aoraki already has, but I'm sure that people will still come here for quite a long time yet (Park manager 2).*

All 12 key informant interviewees were in agreement with the huge increase of tourist numbers predicted for the Park. One respondent suggested that even though more people will go to the Park, their reasons for visiting will be starkly different to visitors in the past:

> *[Visitors] will [continue to visit the Park], but that will get more and more like sitting on a bench seat outside a cafe or a hotel looking at the Park from a distance rather than engaging with the Park. So people will still come, but they'll come for different experiences […] I can still see people coming to the Park, it's just what they come for will change. They'll come for cups of tea and look through binoculars at mountains in the distance (Alpinist 1).*

A few also made reference to Aoraki/Mount Cook still being the main factor in visitors' decision to go to the Park:

> *I don't think Mount Cook is going to go down to a thousand metres, is it? It's iconic, you see […] I think people will still want to go up there, I mean it's a bit like saying would you want to go and look closer at the Matterhorn, of course you're going to do that (Tour operator 1).*

> *The highest mountain in New Zealand is here. And the change is going take a long time, 90 per cent of the glacier is still visible and looking very healthy and we fly people right up to the very top of that. So I think that they'll still keep coming […] it's going to take a long time for it to get to a point where people won't come here because of global warming (Tour operator 2).*
>
> *I think this is where Mount Cook has an advantage perhaps over some of the parks because at the end of the day, it's that big mountain, it's still going to look amazing, it's still going to be there […] The glacier access will deteriorate and so it might be harder to see a glacier, but at the same time, Mount Cook National Park has the advantage that Tasman Glacier has got a third of New Zealand's ice. That glacier is going to be there well after all the other ones are inaccessible, so we may find that more people start to heli-hike and do the trips on the Tasman Glacier because that potentially has got years and years left. I think if anything, Mount Cook National Park needs to be prepared for picking up more people (Scientist 1).*

Another seemed to think that visitors would still have plenty of activity options without involving snow or glaciers:

> *Certainly in the foreseeable lifetime, the mountains will still be there, there will still be permanent snow on the mountains, and a lot of the walks and things don't involve walking on the snow and glaciers. I can't see it having a dramatic effect. Possibly the worst effect is often the case of news media hype on global warming and loss of glaciers (Tour operator 3).*

In slight contrast, another respondent spoke of the increase in visitor numbers and their consequent effects on front-county infrastructure:

> *I don't think you can stop this mass, they are the visitors, they are the ones that put the pressure on and they are the ones that are operating from a very small radius of the centre of the Park really. It's definitely like a ripple in a pond effect that the further away you get, the numbers drop considerably (Alpinist 2).*

Survey respondents were asked a series of questions relating to their willingness to visit the Park under certain glacier recession scenarios. Of the 400 participants, approximately one quarter (23.3%, *n*=93) indicated that they would be 'very willing' to take a flight over or onto the glacier if it was the only way to see a glacier, and 17.8 per cent (*n*=71) reported that they

were ‘not willing at all’ to take a flight. This question caused a lot of confusion among respondents, however, because it was not asking them if they would be willing to take a flight, it was asking them if they would still be willing to visit the Park if they knew that the only way to see a glacier was by flight. Consequently, many comments were made revolving around the cost of taking a flight or fear of flying.

Similarly, 22.8 per cent (*n*=91) of survey participants indicated that they would be ‘very willing’ to visit the Park if they knew that the only way to see a glacier was by crossing a glacial lake with a commercial boat. Most (18.8%, *n*=75) reported being neutral, while 11.3 per cent (*n*=45) said that they were ‘not willing at all’. Again, there was some confusion around what the question meant, but the researcher noticed that comments were more positive towards the idea of taking a boat than they were about taking a flight.

Approximately one third (32.3%, *n*=129) of all respondents indicated that they would still be ‘very willing’ to visit the Park if they were unable to see any glaciers, while only 6.5 per cent (*n*=26) said that they were ‘not willing at all’.

In addition, 34 per cent of respondents (*n*=136) said that they would be ‘very willing’ to go elsewhere in New Zealand to see a glacier if they were unable to see any glaciers at Aoraki/Mount Cook National Park. Only 8 per cent (*n*=12) indicated that they would not be willing.

6.4.3 Park adaptation

When asked about the future of the Park, many key informants made comparisons with how the Franz Josef and Fox glaciers are coping with climate change:

> *I think Aoraki is going to survive a bit better than Westland in terms of visitor use and stuff because it's still easier to access (Conservation planner).*
>
> *Remember Tasman is a much, much larger glacial mass than Fox and Franz. So theirs will probably retreat back to the neve, you'll just get a little tongue coming out, whereas ours will still have quite a big mass coming down unless something catastrophic happens (Park manager 3).*

Another suggested that people are more interested in the Aoraki glaciers, resulting in pressure on the Park to cater to the number increase:

> *There appears to be a switch happening at the moment from the West Coast Glaciers to Aoraki and we might be seeing that in the request for aircraft landings, but that's very problematic because there's no way we want the same aircraft noise problems in Aoraki that they have had at the glaciers, that's just not going to happen (Conservation planner).*

The potential for an emerging 'last chance tourism' was also discussed among interview participants, as two respondents suggested:

> *Short-term future, I think there will be quite a healthy perception of the glaciers as being a kind of last chance to see […] The glaciers will still be seen as a really amazing, unique place to go and see. And I think in the back of peoples' heads, they'll also be thinking 'well we best go see them now' [...] I do see a period of time, say fifty or a hundred years, where the glaciers will possibly become more of a draw point for the general public because people are aware of how special they are. Whether that stirs them to do anything, well that's another story (Alpinist 1).*
>
> *I guess you're going to have this thing where the ongoing retreat is going to eventually make the glaciers less attractive to look at, but the ongoing retreat might make them attractive in terms of actually being able to see a glacier. Maybe we'll see more glacier-oriented tourism, I mean at the moment we've got three companies operated on the hard ice, plus the boats, plus the scenic flights and ski planes, so we've got quite a bit happening on that one glacier already. So I think people will keep going and I think more people will keep going to see the glaciers (Scientist 1).*

A conservation planner summed up his thoughts about glacier recreation and tourism:

> *It's almost inevitable, isn't it, that worldwide glacier-related tourism is slowly going down the gurgler. And there is a need to find ways in actually interacting with the last bits of the glaciers that are there in a relatively safe and easy way […] I'm sorry we haven't left the youngsters with a very good mountain environment (Conservation planner 1).*

6.5 Chapter summary

The findings presented in this chapter highlight the extent to which visitors, tourism operators and managers have experienced climatic change at Aoraki/Mount Cook National, as well as identify the associated challenges for future conservation and recreation enjoyment of this area. These results demonstrate a high adaptive capacity among operators and managers, however, and it is clear that they hold a great level of understanding around the issue and are able to react quickly to change. The visitors sampled in this study also demonstrate a high level of awareness, and results suggest that the Park will remain a much sought after destination despite this time of rapid environmental change. The following chapter discusses the findings presented in the previous two chapters in light of the existing literature in order to address the implications of climate change for glacier recreation and tourism at Aoraki/Mount Cook National Park.

Chapter 7

Concluding discussion

Given the rapidity of glacial recession at Aoraki/Mount Cook National Park in recent years, this study was designed to address key research gaps by investigating the ways in which visitors utilise and experience the Park, as well as their expectations of and satisfaction with the glaciers. Furthermore, key informants were interviewed in order to gauge their perceptions of glacier-related climate change, and how they have already begun responding to its associated impacts.

The following concluding discussion chapter brings together the results from this research with the aim of addressing the implications of climate change for glacier recreation and tourism under five headings representing each of the study's key objectives: the nature of recreation and tourism; the current glacier visitor experience; the implications of climate change on the overall experience of glaciers; the perceptions of climate change among visitors and key informants and the level of awareness around the impacts this may have on resources bound in the Park; and the extent to which the various key informants have responded and adapted to change. Finally, the chapter will outline future research.

7.1 The nature of recreation and tourism

Aoraki/Mount Cook National Park attracts visitors from all over New Zealand and the world due to the array of outdoor recreation opportunities that the alpine environment offers. In fact, it is believed that the Park may begin to witness more than half a million international visitors each year, based on the findings of a Statistics New Zealand international visitors

survey which stated that approximately 407,000 people visited the Park between October and April of 2015-16 (Cavanagh, 2016). Consistent with previous research findings in similar contexts (Wilson et al., 2014; Espiner et al., 2010), the vast majority of survey respondents were first-time visitors to the Park and most were visiting from countries outside of New Zealand. With DOC estimating the Park to attract half a million visitors over the next year, it is not surprising that all the key informants interviewed for this study spoke about this increase in front-country tourism. When asked about how they thought visitors were experiencing the Park, most talked about the popularity of the walking tracks, as well as the opportunity to experience the mountainous landscape first-hand. This was also reflected in the survey findings, with the majority of visitors utilising at least one of the walking tracks in the Park. The most popular track being the Hooker, followed closely by the Tasman, both of which lead to scenic viewing points of the glaciers and glacial lakes. When survey respondents were asked about what influenced their decision to visit the Park, the three most important factors were 'being close to nature', 'the opportunity to witness Aoraki/Mount Cook itself' and 'experiencing a sense of discovery'.

This study utilised DOC's conceptualisation of visitor groups used in their planning tools for the management of national parks. The Recreation Opportunity Spectrum (ROS) is the planning framework that underpins the identification of particular visitor management settings that provide tourists with a range of experience opportunities. This instrument has a strong influence on the overall nature and standard of facilities at all national parks across the country (Clark & Stankey, 1979; DOC, 2004). In addition, the Park's current Management Plan (2004) has adopted five settings appropriate for visitor management based on the seven representative visitor groups outlined in DOC's Visitor Strategy (1996). Consistent with this,

the study identified and categorised the survey participants into three key groups: front-country tourists, commercial glacier tourists and backcountry recreationists. Table 7.1 demonstrates how these groups fit with DOC's two visitor management frameworks.

Table 7.1: Visitor Types based on ROS Settings and DOC's Visitor Groups

Visitor Type	ROS Setting	DOC Visitor Group
Front-country tourists	Front-country, backcountry accessible	Short-stop travellers, day visitors
Commercial glacier tourists	Backcountry accessible, backcountry walk-in	Day visitors, overnighters, backcountry comfort-seekers
Backcountry recreationists	Backcountry remote	Backcountry adventurers, remoteness seekers

As demonstrated in Table, the findings of the visitor survey in this study are consistent with the current Management Plan in that the Park primarily provides for short-stop travellers, day visitors, overnighters and backcountry comfort-seekers within the front-country and backcountry accessible settings, as well as backcountry adventurers and remoteness seekers within the backcountry walk-in and backcountry remote settings. Although the Management Plan suggests that the Park is not seen as a primary location for backcountry comfort-seekers, it can be argued that those using the scenic flight or landing services or those visiting Mueller Hut could be characterised by this label. A seventh DOC visitor group, 'thrill seekers' was not represented in the survey sample, and is not a group that is typically found in the Park. Although it could be argued that mountaineering displays elements of thrill seeking, alpinists are traditionally classified by DOC as backcountry adventurers or remoteness seekers (DOC, 2004).

In more fundamental terms, however, Aoraki/Mount Cook National Park visitors are often categorised as two distinct groups: the backcountry recreationists and the front-country tourists. According to key informants interviewed for this study, these groups have always had limited interaction with one another given that they have traditionally utilised very separate areas of the Park. One theme that arose during the interviews, however, was the recent blurring of the Park's front-country and backcountry spatial boundaries among tourists and recreationists. For example, more tourists are beginning to branch out from the front-country (facility-oriented) areas, such as the Tasman or Hooker Valleys, to the backcountry areas of the Park. This shift has become increasingly more evident at the Mueller Hut, for instance, which was typically used by mountaineers as a base between expeditions, however now attracts large numbers of tourists year-round. This has resulted in the management differentiation between recreation and tourist activities becoming increasingly less clear in recent years. As highlighted by many of the interviewee participants, this also dramatically increases the potential for conflict between visitor groups.

Three themes emerged from the findings in terms of the importance of the Park for the key informants: emotional attachment, livelihood reliance and the historical and cultural significance of the area. Most had been personally affiliated with the Park for a number of years, particularly those that lived or worked in the Park long-term, and many spoke of the reliance of the Park to the success of their own employment. It can be said, however, that personal attachment with the Park was most evident in regard to their involvement in backcountry recreation activities. Most were able to give very detailed descriptions of changes to various climbing routes or infrastructure, particularly backcountry huts, for which they demonstrated a high level of passion and personal connection. It is this particular user

group that appears to have experienced the most significant impacts as a result of climate change. This was evident among interviewees' discussions around an increasing lack of accessibility to the high-alpine areas of the Park, safety risks, and removal of backcountry facilities. It was also particularly evident among the backcountry recreationists that the increase in helicopter activity had challenged the historical principles and morals of New Zealand climbing, and it was clear that some of them were not happy with the way modern climbers were experiencing the Park and appeared almost saddened that traditional methods of climbing, for example walking into the mountains, had become almost non-existent.

7.2 The current glacier visitor experience

Assessing the level of importance of the glaciers for visitors was a key interest in the study and therefore a main focus of the survey questions. The results suggest that the glaciers are very important to people currently visiting the Park. Although Aoraki/Mount Cook itself has proven to be the main drawcard for visitors, 'the opportunity to witness a glacier' and, even more so, 'seeing a glacial lake with icebergs' were also leading factors in why people chose to visit the Park. There was, however, far less interest in 'the opportunity to learn about the impacts of climate change on the glaciers', which may suggest that visitor interest in the glaciers is somewhat oriented toward seeing the features rather than learning about them. Thompson-Carr's (2012) study also stated that many visitors' experiences could be viewed as superficial given their primary focus on sightseeing as opposed to connecting with the Park, even though an element of learning may occur.

Although not a key reason for visiting the Park, many visitors were observed reading information about the glacier via the interpretation panel at the Tasman Glacier viewing point

and inside the visitor centre. It can be said, however, that the visitors in this study predominantly experienced the glaciers by simply observing them, and to a much lesser extent, by taking part in a commercial activity, for example flying over or onto them, or boating or kayaking across the pro-glacial lakes. The three aspects of the glacier experience (the size of the glacier, the appearance of the glacier ice and how spectacular the glacier ice was overall) were directly taken from the study undertaken at the West Coast glaciers (Wilson et al., 2014). As was examined in their findings, this study provides a clear relationship between expectation and satisfaction of the glacier visitor experience. Satisfaction was greatest when the visitor experience exceeds expectation. In the case of both of these studies focusing specifically on the glacier experience, satisfaction occurred when visitors encountered a larger glacier, cleaner ice and a more spectacular glacier than they had expected prior to their visit.

In contrast to the West Coast study, however, far fewer visitors had seen images of the Aoraki/Mount Cook glaciers before they visited the Park. This is likely indicative of the fact that the glaciers were not the most important factors for visitors when choosing to go to the Park, and therefore not something that they would feel the need to investigate beforehand. This could arguably present park managers with an ideal opportunity to focus advertising efforts more specifically on the Aoraki glaciers, particularly given the large number of survey respondents who reported that they had either just come from the West Coast glaciers or were heading there afterward, indicating that people are interested in glaciers, but are not necessarily associating Aoraki/Mount Cook National Park as a place for experiencing them.

Consistent with the literature on satisfaction with nature-based tourism experiences (Chhetri et al., 2004; Moore et al., 2015), although glaciers per se were not the primary reason for

visiting the Park, and individual aspects of the glaciers' appearance did not always match the expectations of visitors, this study revealed high levels of satisfaction with the overall glacier experience. Based on this study's sample, the majority of visitors were seeing the Park for the first time, and therefore it was anticipated that they would accept the conditions they encountered as 'normal' for the place, an effect first documented as 'the last settler syndrome' during the early years of outdoor recreation research (Shelby & Heberlein, 1986). This means that having accurate and up-to-date information on the glaciers and the glacier activities available to visitors is extremely important, and this is likely to present significant challenges for park managers in the future as accessibility becomes increasingly more difficult.

Many interviewees suggested that the experiences of visitors accessing the front-country areas of the Park had improved as a result of facilities and infrastructure being upgraded, as well as the increase in commercial activities being made available. This was particularly evident when interviewees discussed the upgrades to the visitor centre and the popular Hooker Valley Track. While most interviewees talked positively about the increase in commercial activities being offered in the Park, there were some mixed opinions on where developments had been targeted. For example, some were concerned that more effort had been made in upgrading front-country facilities and not enough on those located in the backcountry areas, which arguably requires greater attention due to their position. From a management perspective, interviewees often discussed the challenges of balancing the need for new development and preserving the natural and historical elements of the Park.

7.3 Implications of climate change on the experience of glacier visitors

As discussed by Gössling and Hall (2006), the main impacts of climate change for recreation and tourism include those caused by variations in temperature and precipitation, as well as other climatic variables such as snow depth, wind speed and humidity, which will all have a direct effect on the experiences and activities of tourists and recreationists. In terms of the glacier experience specifically reported in the current study, favourable atmospheric conditions are crucial for both the satisfaction of visitors and the success of the commercial glacier operations. A common example that emerged from the interviews was the difficulties that flight operations are experiencing as a result of the changing climate. Ski plane operations, in particular, have been struggling with the warmer weather resulting in a lack of snow during certain periods of the year. Many interviewees claimed that this had severely limited ski planes, to the point where operators are now predominantly using helicopters to ensure that they are not so restricted by weather patterns and snow levels. This is also the case for Westland *Tai Poutini* National Park aircraft operators, who use helicopters for almost all of their services (Wilson et al., 2014).

Conversely, the increase in the size of the pro-glacial lakes has allowed tourism operations to take advantage of the diminishing resource. Based on the interview data, as well as field observations, the boat tours at the Tasman Glacier are extremely popular among tourists and spoken of highly in most cases. Given that the West Coast glaciers are becoming increasingly less accessible because of climate-induced change, most key informants discussed the fact that Aoraki/Mount Cook National Park is likely to witness an increased demand for glacier experiences, which will undoubtedly put additional pressure on park managers and operators to cater to the visitor growth. This switch from the West Coast glaciers to Aoraki/Mount Cook

was also talked about in relation to the potential request for additional aircraft landings in the Park, which has implications for the management of mechanical noise and associated visitor experience issues such as those previously reported at the West Coast glaciers in recent years (Espiner & Wilson, 2013; 2015) years. According to the Park's Management Plan, DOC only has a direct influence on aircraft use through concessions management and monitoring, however landing restrictions and working alongside operators to adjust flight paths and altitudes are listed as plausible tools for managing the effects of aircraft use as well (DOC, 2004, section 4.3). The Plan also states that the biggest complaint raised surrounding this aircraft issue is *"the noise they generate in an otherwise undisturbed mountain environment" (p. 36).* Although aircraft operations are a well-established and long-standing visitor service in the Park, it can be said, therefore, that they do need strict control in order to minimise the impacts.

An aim of this study was to determine the extent to which glaciers are a factor in tourists' decisions to visit the Park, and whether or not they would still visit if the glaciers were no longer able to be easily accessed. As discussed in the limitations section of the methods chapter, many thought that the climate-related scenario questions were asking them to indicate how willing they would be to take a flight or boat to see a glacier as opposed to how willing they would be to visit a glacier if they had to use one of those modes of transport to see one, as was used for the survey based on the West Coast glaciers (Wilson et al. 2014). Although it is difficult to draw definitive conclusions from these two particular questions, most respondents reported that they would still be willing to visit the Park if they were unable to see any glaciers there at all. It could be argued that this response is linked to the importance of glaciers as an attraction more generally, in the sense that glaciers were not the main

drawcard for visitors. In fact while answering this question, many survey respondents stated that there is still plenty of other things to see and do in the Park that do not include glaciers. Additionally, most also reported that they would be willing to go elsewhere in New Zealand to visit a glacier if they were unable to see one at Aoraki/Mount Cook National Park. This finding was consistent with the West Coast results (Wilson et al., 2014) and may also indicate the potential for destination substitution, a finding that was also revealed in Dawson's et al. (2010) study on polar bear viewing and Bürki's (2005) study on skiers traveling to other countries for better and more reliable skiing conditions.

Similarly, activity substitution may also be high among tourists as well. According to Jenkins and Pigram (2004), the concept of substitutability proposes that if the satisfaction level of a person drops below a certain point, they will look for alternative *"activities, products, or services that offer a better return for the amount of time, money, and energy spent" (p. 489).* Given that very few commercial glacier tourists were recruited for this study, it is difficult to determine whether or not it is common for these visitors to undertake other activities in the Park as well as their chosen glacier-related ones, however of the commercial tourists who did complete a survey, all were recruited on one of the walking tracks. Based on this, it can be suggested that tourists will continue to visit the Park regardless of whether the glaciers and their associated activities were to become less accessible.

This is not necessarily the case for backcountry recreationists, however. Based on the interview data, it is clear that the patterns in mountaineering have altered significantly in recent years and are likely to continue in this trend. Climbers have already demonstrated changes in the length of their trips and in the way they access the mountains, although it is acknowledged that changes in climbing styles are not only the result of altered climate

conditions. According to the key informants interviewed for this study, most mountaineers today are chasing weather windows and doing shorter, more targeted trips and utilising the helicopter operations to get in and out of the mountains. It is also likely that factors such as changes in technology, increased time constraints, and the availability of helicopters have had an influence of some of these changes, particularly in terms of trip lengths and where climbers go. However, glacial recession has made it increasingly more difficult for climbers to access the mountains by walking in, and it has also meant that a number of backcountry huts have been removed due to their unstable position. Both of these factors have made mountaineering much more difficult and dangerous, which has seemingly led to many climbers either choosing to climb elsewhere or, in some cases, giving up climbing altogether and taking up other sports.

Although winter tourism and recreation has been consistently identified as being particularly vulnerable to climate change, and has received greater research attention than any other tourism sector, it has been the ski industry that has been the particular focus of impact assessments, particularly in Europe and North America (Koenig & Abegg, 1997; Elsasser & Bürki, 2002; Scott et al., 2003). Much of the literature provides evidence that experienced skiers are choosing to travel to other countries in search of better snow conditions (Koenig & Abegg, 1997; Bürki, 2005), while some have indicated that they would discontinue skiing entirely if conditions did not improve in their home countries, especially those wanting to visit the backcountry areas of mountains where climate change poses a much greater avalanche risk (Scott et al., 2003; Bürki, 2005).

7.4 Perceptions of climate change and level of awareness

Understanding tourist perceptions of environmental change is extremely important for destinations that are susceptible to climatic change (Scott et al., 2006; Gössling & Hall, 2006; Hall & Lew, 2009), particularly in the context of mountain tourism, whereby the perceived quality of the alpine environment is a key factor in visitor attraction (Scott, Jones & Konopek, 2008). Although most key informant interviewees were not convinced that visitors to the Park were aware of the impacts of climate change, according to the results of this study there was a high level of agreement across both visitors and key informants that climate change is occurring right now. There were mixed opinions among participants, however, over the cause of climate change. Although all 12 of the interviewees and over 80 per cent of survey respondents agreed that human activity was the primary cause of climate change, there was less certainty over whether there was a natural element involved as well. Levels of concern about climate change were also extremely high among survey respondents and interviewees, and most were in agreement that the glaciers in the Park would get smaller over the next twenty years as a result of climate change. Therefore, contrary to the perception of the key informants, it does appear that visitors have an understanding of at least some of the effects of the changing climate conditions, particularly in regards to the recession of glaciers. Again, these findings were consistent with the results from the West Coast study (Stewart et al., 2016), whereby participants of the visitor survey indicated a high level of awareness and concern surrounding the impacts of climate change. As is commonly reported elsewhere in the research literature (Booth and Peebles, 1995; Manning et al., 2002), the survey respondents were highly educated, with over two-thirds having a university education. Scott et al. (2012) argue, however, that the perceptions of the modern-day visitors may not be the same for future generations. They claim that despite the concern among current visitors that

climate change is negatively impacting mountain destinations, the temporal scale of such changes might result in the eventual impact on visitation reducing as the frame of reference of mountain landscapes broadens.

Despite attempts by tourism operators and park managers to allow visitors access to view the glaciers via walking tracks, scenic flights, boat tours and other mechanised means, the findings of this study suggest that the trips that visitors make to the Park are not primarily driven by the opportunity to witness the glaciers. Again, the Park's tourism operators may see potential in using the education opportunities that the 'last chance to see' phenomenon presents by drawing attention to the fact that glaciers are becoming an increasingly scarce resource. According to Dawson et al. (2011), last chance tourism requires a tourism feature that is perceived to be vulnerable or rare, as well as a tourist incentive to experience this feature while it is still possible. As a region that is highly reliant on the glaciers for attracting visitors, the tourism industry on the West Coast has already seen some operators utilising the 'last chance tourism' dimension for the marketing of their glaciers (Stewart et al., 2016). Outside New Zealand, polar bear viewing tourism in the Arctic regions is a more widely known example of the phenomenon of last chance tourism (Dawson et al. 2011).

According to the key informants, the redevelopment of the visitor centre has provided context for visitors around the impacts of climate change in the Park by painting a picture of what the landscape used to look like in previous years. The interpretation panel at the Tasman Glacier viewing point also allows visitors to get a sense of how rapidly the glacier's appearance has changed, although some survey respondents expressed the suggestion for a similar panel at the Hooker Glacier as well. In fact, it was noted by the researcher that some visitors at the Hooker Valley viewing point were unaware that they were even looking at a glacier. It is not

surprising, therefore, that a common trend in the interview data was the idea that the recession of the glaciers was presenting new opportunities for increased education and interpretation as a way of informing visitors on the realities of climate change within the Park. A study conducted by Powell and Ham (2008) suggested that well-designed and delivered interpretation can increase knowledge of the destination, general environmental behavioural intentions, and supportive attitudes towards conservation efforts. Similarly, Tubb (2003) states that if carefully designed, interpretation is capable of restructuring knowledge and behavioural intentions of visitors. Furthermore, based on participant observation carried out in a national park visitor centre in the United Kingdom, she revealed that interactive material played a vital role in the effectiveness of the interpretive messages being presented (Tubb, 2003).

7.5 Response and adaptation

According to Lemieux et al. (2011), the rapidly changing climate presents new and difficult challenges for the future management of protected areas worldwide. Equally, as Becken (2013) points out, *"the challenge of climate change is also an opportunity for tourism to become more systematic, smart, strategic and sustainable" (p. 352).* Many of these aforementioned changes have already triggered the need for adaptation, particularly among managers and operators, which is indicative of the flexibility required in order to survive in such a dynamic and changing setting such as Aoraki/Mount Cook National Park. Stewart et al. (2016) argue that a willingness and capacity to expand and diversify products is the key to successful adaptation, whereby in the case of this particular setting, access to the glaciers is

facilitated and glacier products are made available to ensure high levels of visitor satisfaction are maintained.

According to Smit and Pilifosova (2003), *"adaptation to climate change has the potential to substantially reduce many of the adverse impacts of climate change and enhance beneficial impacts" (p. 879)*. Conversely, Mashall et al. (2013) state that climate change awareness is associated with enhanced adaptive capacity. It is claimed that of all elements in the tourism system, tourists have the largest adaptive capacity *"because of their flexibility to substitute the place, timing and type of holiday, even at short notice"* (Gössling, Scott, Hall, Ceron & Dubois, 2012, p. 36). This highlights the importance of understanding tourist perceptions and responses to the impacts climate change in order to anticipate possible seasonal and geographic shifts in tourism demand, as well as the potential increase or decline of particular tourism markets (Becken, 2013). It is evident from the findings of this study that the key informants interviewed have a high capacity for adaptation, demonstrated by their considerable understanding of the trends of climate change. However, although it was clear that operators have the flexibility to react quickly, park managers acknowledged that it is more difficult in their role to be nimble and responsive as a result of the relatively static Management Plan review process putting limits on future adaptation. Scott et al. (2009) argue that previous research undertaken in other glaciated regions internationally suggests that due to having such a high dependence on the glaciers, operators, and the regions more generally, have a relatively low adaptive capacity.

Wiens, Seavy and Jongsomjit (2011) argue that thus far, the adaptation of conservation strategies to accommodate the changes in climate *"have focused on enhancing resistance or resilience, while preparing for ecological transformation has received less attention" (p. 2119).*

The rapid recession of glaciers worldwide highlights the strong need for a thorough understanding of climate change in order for the management of protected areas to align with the rate in which conditions are changing. While all interviewees made a strong point that they expect climate-related challenges to continue in the future, they remain positive in their ability to be able to foresee and respond appropriately. In fact, this has been demonstrated already in the way tourism operators have diversified the glacier product and introduced a variety of mechanised modes of transport to access the glaciers, for example boating and 4WD and Argo tours. Interviewees not involved in commercial operations, however, were concerned that the Park will see dramatic changes in aerial access policies in the coming years, as has been the case on the West Coast (Stewart et al., 2016). Although they acknowledge that aircraft activity has allowed more visitors the opportunity to get closer to the glaciers, the subsequent costs to the environment and potential effects on aspects of visitor experience are causing apprehension for some of the interviewees.

In addition, many of the operators indicated that there is some tension for them around supporting new developments, which in turn create income for their businesses, and the concern that such developments go against the traditional values that the operators associate with the Park. This dilemma was particularly evident among the alpinists who work in the Park as guides but also use the mountains for their own personal use. It was clear that they felt conflicted between the obvious benefits of their companies increasing their aircraft use, for instance, but at the same time they acknowledged that mountaineering has traditionally involved walking in and out of the mountains. Similarly, park managers are faced with the challenge of balancing conservation policy and commercial advantages.

It is not all doom and gloom, however. As previously outlined, these challenges do also present opportunities for illustrating the facts and educating visitors about the impacts of climate change. According to Kohl (2005), "*environmental interpretation has its roots in conservation" (p. 31)*, and it is now widely recognised for its importance in conserving natural and cultural resources. Thoughtful interpretation holds great potential in allowing visitors to witness the effects of climate change first-hand, and may even assist in achieving the Park's broader conservation goals. As argued by Stewart et al. (2016), the successful delivery of conservation messages has the ability to create environmentally protective attitudes and behaviours among visitors, not just at a local scale, but in a range of broader contexts as well. In fact, it was suggested by a number of key informants, in both management and commercial operator roles, that the opportunity to learn about the issues of climate-related issues had become much more of a priority in the planning and implementation of visitor management strategies in recent years. As with any agencies in the public sector, DOC not only have the role of delivering a range of quality visitor services to users of the Park, but also have an obligation to meet broader conservation objectives, all of which have conflicting needs and levels of urgency. As examined in a study by Archer and Wearing (2002), the use of interpretation and marketing as management tools can provide park operators and managers with the ability to effectively manage visitors to the Park, as well as to build stronger relationships with the wider community, and therefore offering a proactive and realistic approach to meeting core conservation objectives. It can be said, therefore, that while the rapidly changing conditions of the Park are creating a number of obstacles for managers and operators in finding a healthy balance between conservation policy and visitor experience, the diminishing glaciers also offer new opportunities building awareness among the Park's visiting and wider community.

7.6 Conclusion

The far-reaching implications of climate change for recreation and tourism at Aoraki/Mount Cook National Park identified by the visitors and key informants who took part in this study illustrate the many challenges facing climate-sensitive regions worldwide. Given the extent to and rate at which the effects of climate is changing are influencing this particular setting, it is now both critical and timely that the Park's adaptive strategies be explored and evaluated in order to raise awareness and share knowledge with other protected areas experiencing diminishing natural resources.

This study sought to address key research gaps in the emerging field of glacier recreation and tourism by identifying the current and potential future climate-related impacts on tourism operations, park managers and the visitors themselves from both a supply and demand perspective through the following five research objectives:

1) Understanding the nature of recreation and tourism

2) Outlining the current glacier visitor experience

3) Investigating the implications of climate change on the glacier visitor experience

4) Exploring the perceptions of climate change among visitors and key informants and the level of awareness around the impacts this may have on resources bound in the Park

5) Examining the extent to which the various stakeholders are responding and adapting to change

As an iconic tourist destination in New Zealand, as well as experiencing extraordinary rates of climatic change, Aoraki/Mount Cook National Park offers an ideal setting for exploring the ways in which various stakeholders have already begun responding to the recession of a resource so highly relied on by tourism and recreation, as well as to reflect on these findings

in light of current and future implications for the Park's management strategies. The relevance of this study lies in its timeliness with the current review of the Park's Management Plan, making research of this nature incredibly critical.

Responding to the calls for the integration of both social and natural science perspectives in order to gain a thorough understanding of the ways in which climate change is being perceived and responded to in the Park, this study adopted a mixed-methods approach to gather information from both visitors and key informants. As is also pointed out by a number of researchers in recent years (Smiraglia et al., 2008; Purdie, 2013; Welling et al., 2015), it is suggested that future research in this field also adopt a mixed-method approach to allow for the sharing of knowledge among all those involved in the management of protected areas, as well as to raise awareness among local communities and achieve broader conservation goals. In addition, adaptation can be aided by utilising glaciological research to contribute to the Park's overall management and policy development.

By investigating the impacts of climate change and the associated responses in the context of glacier recreation and tourism experiences, this study allows for a more thorough understanding of the drivers behind the last chance tourism phenomenon. Although this concept might not be necessarily relevant for Aoraki/Mount Cook National Park at the present time, the ability to continue to attract visitors is undoubtedly vital to the survival of this destination. The management of visitor expectations is extremely difficult under constantly changing climate conditions, and therefore the last chance tourism concept may be used as a short-term adaptation tool in future years.

While this study focused primarily on the glacier experience in a New Zealand national park, the findings contribute to the broader field of glacier recreation and tourism and offer a

comparative foundation for future studies seeking to address other forms of activities and environmental settings in the context of protected area management.

With our environment currently experiencing unprecedented change (IPCC, 2013), and tourism and recreation patterns continuing to shift in response to the emerging conditions, the future of protected area management is faced with a number of new and complex challenges. As long-standing barometers of climate change (McDowell et al., 2014; Stewart et al., 2016), glaciers play a critical role in highlighting the extreme vulnerability of mountain settings, in which scenic amenity and visitor attraction is critical. Although set in Aoraki/Mount Cook National Park, this work is part of a much broader picture of investigating, documenting and informing planners about the management of dynamic environments under current climate-induced scenarios.

7.7 Future research

A key limitation of this study was the difficulty in recruiting visitors undertaking commercial activities. It is therefore suggested that future visitor surveys focus specifically on commercial tourists as this particular visitor group was underrepresented in this study and they are of particular importance given that many of the activities they undertake are glacier-related.

Given the current rapid rate of glacial recession, as well as the fact that there has now been two very similar studies based on the glacier visitor experience undertaken in New Zealand's most popular glaciated regions, an area of interest for future research in the field of glacier tourism is the extent to which visitors are likely to react and engage with new or different glacier experiences or activities. In addition, given the fact that the Tasman Glacier is likely to

respond differently than the coastal glaciers under climate change scenarios, this may place increased pressure on the glaciers on the eastern side of the main divide. With the Franz Josef and Fox Glaciers becoming less accessible, and in light of the literature around 'substitution', it is possible that people might opt to go elsewhere to see glaciers. It is therefore suggested that a wider scale project be undertaken in order to assess glacier tourism on a national level as opposed to a local level.

Finally, it would also be interesting to explore the perceptions of climate change impacts for those visitors who travel great distances to see glaciers, particularly among those international visitors. With the majority of survey participants believing that climate change was very concerning and was primarily a result of human activity, a study of how these beliefs influence their behaviour would be worth exploring.

Appendix A

Survey form

Participant ID #:
Date:
Time:
Location:
Surveyor:
Weather:

Aoraki/Mount Cook National Park Visitor Survey

Hello, I am from Lincoln University and I am doing a survey of visitors to Aoraki/Mount Cook National Park as part of my Master's thesis at Lincoln University.

This survey has questions about your visit to the Park, including:

- The activities you are undertaking while at the Park
- Your motivations for visiting the Park
- Your expectation and satisfaction levels

There are also some questions about your thoughts on glaciers and climate change.

Your participation in this survey is voluntary and will take about 10 minutes to complete.

The survey is anonymous and you can choose not to answer any, some, or all questions. You can withdraw from the study at any time during the survey without explanation. If you complete the survey, however, it will be understood that you have consented to participation in the study and agree to publication of the results with the understanding that anonymity will be maintained.

If you require any further information about this study I have an information sheet I can give you which includes relevant contact details.

To make it easier for you I will ask you the survey questions and record your answers.

Part A: Your visit to Aoraki/Mount Cook National Park

1) Is this your first time visiting Aoraki/Mount Cook National Park?

1. ☐ Yes (Go to Q. 4) 2. ☐ No (Go to Q. 2 & 3)

2) If no, can you remember approximately what year you first visited the Park? _____

3) Can you estimate the number of times you have previously visited the Park?

1. ☐ 2-5 times
2. ☐ 6-10 times
3. ☐ 11-15 times
4. ☐ 16-20 times
5. ☐ 20+ times (approximately _____ times)

4) Who are you visiting Aoraki/Mount Cook National Park with?

1. ☐ Alone
2. ☐ Family
3. ☐ Friends
4. ☐ Friends & family
5. ☐ Organised tour group
6. ☐ Other (_____)

5) How many people are in your group? _____ people (include individual in total)

6) How much time will you spend at Aoraki/Mount Cook National Park today?

1. ☐ Less than 4 hours
2. ☐ Half a day
3. ☐ A full day (not overnight)
4. ☐ Overnight (____ night)
5. ☐ Not sure

7) (a) What are the <u>main</u> activities that you have already undertaken <u>or</u> will definitely undertake while at Aoraki/Mount Cook National Park and (b) where have/will these activities take(n) place? <u>(Refer to map)</u>

Participant unsure ☐ (Go to Q. 11)

	1. Village area	2. Bush tracks around village	3. White Horse Hill Campground	4. Red Tarns Track	5. Kea Point Track	6. Sealy Tarns Track	7. Hooker Valley Track	8. Mueller Hut Route	9. Tasman Glacier	10. Blue Lakes / Tasman Glacier View	11. Tasman Lake Walk	12. Ball Hut Route	13. Alps 2 Ocean Cycle Trail	14. Other (state)	15. Other (state)
1. Visitor centre / Hermitage visit															
2. Sight-seeing / photographing															
3. Camping															
4. Biking															
5. Kayaking															
6. Day hiking															
7. Multi-day / overnight hiking															
8. Glacier lake boat tour															
9. Scenic flight															
10. Glacier snow landing / hike															
11. Heli-skiing															
12. Backcountry skiing															
13. Mountaineering															
14. Paragliding															
15. Hunting															
16. Other (state)															
17. Other (state)															

8) I am particularly interested in glaciers for this project, were you aware of the glaciers in this national park prior to your visit?

1. ☐ Yes 2. ☐ No

9) Do you recall seeing any glaciers during your visit to the Park?

1. ☐ Yes (Go to Q. 10) 2. ☐ No (Go to Q. 11. a) 3. ☐ Not sure (Go to Q.11. a)

10) If yes, (a) what had you expected that/those glacier(s) to be like and (b) how satisfied were you with what you saw? (Refer to answer booklet)

				Very dissatisfied						Very satisfied
a)	I expected the size of the glacier(s) to be…	1 2 3 4 5 6 7 8	Much smaller Much bigger Not sure	1	2	3	4	5	6	7
b)	I expected the glacier(s) ice to look…	1 2 3 4 5 6 7 8	Much dirtier Much cleaner Not sure	1	2	3	4	5	6	7
c)	Overall, I expected the glacier(s) to be…	1 2 3 4 5 6 7 8	Much less spectacular Much more spectacular Not sure	1	2	3	4	5	6	7

11) (a) Did you see any images of the Aoraki/Mount Cook glacier(s) and/or glacial lake icebergs before your visit?

1. ☐ Yes (Go to Q. 11b) 2. ☐ No (Go to Q. 12) 3. ☐ Not sure (Go to Q. 12)

(b) If yes, in these images, how accurate was the portrayal of the current condition of the glacier(s) and/or glacial icebergs? (Refer to answer booklet)

Not accurate at all Very accurate

1. ☐ 2. ☐ 3. ☐ 4. ☐ 5. ☐ 6. ☐ 7. ☐

12) (a) How important were the following factors in your decision to visit Aoraki/Mount Cook National Park and (b) how satisfied are you with these factors in terms of the impact of each on your visit? (Refer to answer booklet)

				Very dissatisfied						Very satisfied	Not applicable
a)	The forecast weather conditions	1 2 3 4 5 6	Not important at all	1	2	3	4	5	6	7	8

		7	Very important								
b)	Being with friends and/or family The opportunity to be with friends and/or family	1 2 3 4 5 6 7	Not important at all Very important	1	2	3	4	5	6	7	8
c)	Being close to nature The opportunity to be close to nature	1 2 3 4 5 6 7	Not important at all Very important	1	2	3	4	5	6	7	8
d)	Witnessing Aoraki/Mount Cook itself The opportunity to witness AMC itself	1 2 3 4 5 6 7	Not important at all Very important	1	2	3	4	5	6	7	8
e)	Experiencing an uncrowded setting The opportunity to experience an uncrowded setting	1 2 3 4 5 6 7	Not important at all Very important	1	2	3	4	5	6	7	8
f)	Being in a challenging environment The challenge of the environment	1 2 3 4 5 6 7	Not important at all Very important	1	2	3	4	5	6	7	8
g)	Experiencing a sense of discovery The opportunity to experience a sense of discovery	1 2 3 4 5 6 7	Not important at all Very important	1	2	3	4	5	6	7	8
h)	Having a story to tell The opportunity to have a story to tell	1 2 3 4 5 6 7	Not important at all Very important	1	2	3	4	5	6	7	8
i)	Experiencing places I have read about The opportunity to experience places I have read about	1 2 3 4 5 6 7	Not important at all Very important	1	2	3	4	5	6	7	8
j)	Witnessing a glacier The opportunity to witness a glacier	1 2 3 4 5	Not important at all	1	2	3	4	5	6	7	8

		6 7	Very important								
k)	Seeing a glacial lake with icebergs The opportunity to see a glacial lake with icebergs	1 2 3 4 5 6 7	Not important at all Very important	1	2	3	4	5	6	7	8
l)	Getting close to a glacier The opportunity to get close to a glacier	1 2 3 4 5 6 7	Not important at all Very important	1	2	3	4	5	6	7	8
m)	Learning about the impacts of climate change on glaciers The opportunity to learn about the impacts of CC on glaciers…	1 2 3 4 5 6 7	Not important at all Very important	1	2	3	4	5	6	7	8

13) Do you have any additional comments about any of these factors?

Part B: Your perspectives on glaciers and climate change

14) Have you visited a glacier before this trip to Aoraki/Mount Cook National Park?

1. ☐ Yes (Go to Q. 15) 2. ☐ No (Go to Q. 16)

15) If yes, in what parts of the world have you visited glaciers before?

1. ☐ New Zealand (_____ glacier)
2. ☐ North America
3. ☐ Europe
4. ☐ Other (_____)

16) To what extent do you agree with the following statements about climate change? (<u>Refer to answer booklet)</u>

		Completely disagree						Completely agree
a)	Climate change is occurring right now	1	2	3	4	5	6	7
b)	Climate change is the result of natural causes	1	2	3	4	5	6	7
c)	Climate change is the result of human activity	1	2	3	4	5	6	7
d)	Climate change is very concerning	1	2	3	4	5	6	7

17) What do you think will happen to glaciers in Aoraki/Mount Cook National Park over the next 20 years? <u>(Refer to answer booklet)</u>

1. ☐ Advance significantly
2. ☐ Advance slightly
3. ☐ Remain the same
4. ☐ Recede slightly
5. ☐ Recede significantly
6. ☐ Disappear entirely
7. ☐ Not sure

18) How willing would you be to visit Aoraki/Mount Cook National Park if you knew the ONLY way to see a glacier was to take a flight over/onto the glacier? (Refer to answer booklet)

Not willing at all Very willing

1. ☐ 2. ☐ 3. ☐ 4. ☐ 5. ☐ 6. ☐ 7. ☐ 8. ☐ N/A (Go to Q. 22)

19) How willing would you be to visit Aoraki/Mount Cook National Park if you knew the ONLY way to see a glacier was by crossing a glacial lake with a commercial boat? (Refer to answer booklet)

Not willing at all Very willing

1. ☐ 2. ☐ 3. ☐ 4. ☐ 5. ☐ 6. ☐ 7. ☐

20) How willing would you be to visit Aoraki/Mount Cook National Park if you were unable to see a glacier at all? (Refer to answer booklet)

Not willing at all Very willing

1. ☐ 2. ☐ 3. ☐ 4. ☐ 5. ☐ 6. ☐ 7. ☐

21) If you were unable to see a glacier at Aoraki/Mount Cook National Park, how willing would you be to go elsewhere in New Zealand to see one? (Refer to answer booklet)

Not willing at all Very willing

1. ☐ 2. ☐ 3. ☐ 4. ☐ 5. ☐ 6. ☐ 7. ☐

Part C: About you

22) What is your age? (Refer to answer booklet)

1. ☐ 18-19 years
2. ☐ 20-29 years
3. ☐ 30-39 years
4. ☐ 40-49 years
5. ☐ 50-59 years
6. ☐ 60-69 years
7. ☐ 70-79 years
8. ☐ 80+ years

23) With which gender do you most identify? (Refer to answer booklet)

1. ☐ Male
2. ☐ Female
3. ☐ Other
4. ☐ Prefer not to answer

24) What is your highest education level? (Refer to answer booklet)

1. ☐ Primary/elementary school
2. ☐ Secondary/high school
3. ☐ Training/trade
4. ☐ University
5. ☐ Other

25) Where do you normally live?

1. ☐ New Zealand (go to Q. 26)
2. ☐ Australia
3. ☐ China
4. ☐ United States of America
5. ☐ United Kingdom
6. ☐ Japan
7. ☐ Germany
8. ☐ Canada
9. ☐ Other (_____)

26) If you live in New Zealand – which region?

1. ☐ Southland
2. ☐ Otago
3. ☐ Canterbury
4. ☐ West Coast
5. ☐ Marlborough
6. ☐ Nelson
7. ☐ Tasman
8. ☐ Wellington
9. ☐ Manawatu-Wanganui
10. ☐ Taranaki
11. ☐ Hawkes Bay
12. ☐ Gisborne
13. ☐ Bay of Plenty
14. ☐ Waikato
15. ☐ Auckland
16. ☐ Northland

27) Finally, do you have any questions for me?

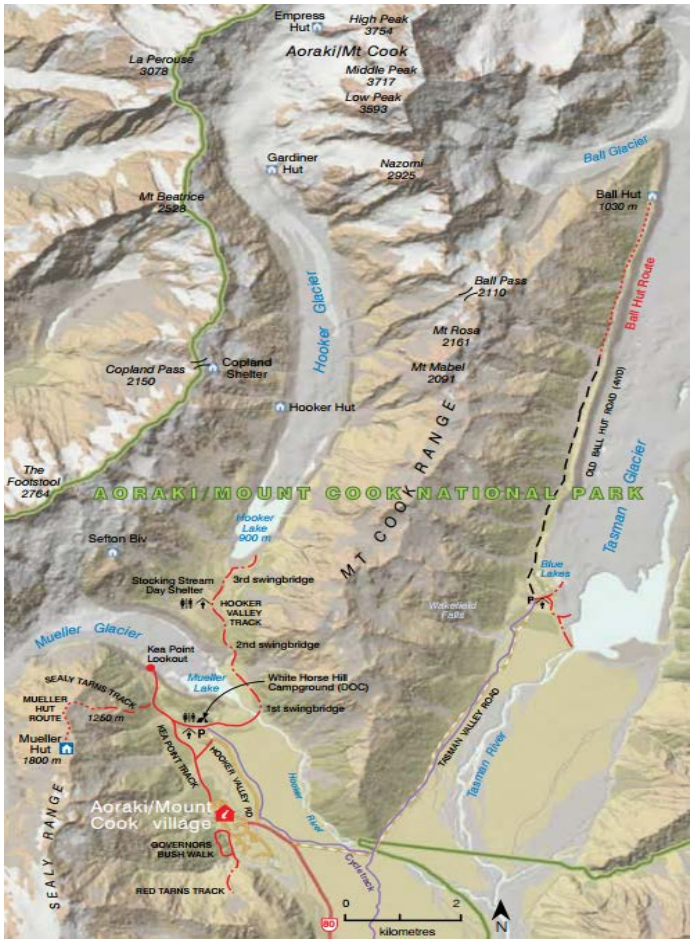
Thank you very much for completing this survey with me – I hope you enjoy the rest of your time at Aoraki/Mount Cook National Park

Appendix B

Survey participant booklet

Aoraki/Mount Cook National Park Visitor Survey

Participant answer booklet



Q. 8 (a-c) Your expectations and satisfaction with the glacier (only to be answered if you have seen a glacier on your visit so far)

I expected the size of the glacier to be …

1 Much smaller	2	3	4	5	6	7 Much bigger	8 Not sure

How satisfied were you with the size of the glacier?

1 Very dissatisfied ☹	2	3	4	5	6	7 Very satisfied ☺

I expected the glacier ice to look …

1 Much dirtier	2	3	4	5	6	7 Much cleaner	8 Not sure

How satisfied were you with what the glacier ice looked like?

1 Very dissatisfied ☹	2	3	4	5	6	7 Very satisfied ☺

Overall, I expected the glacier to be …

1 Much less spectacular	2	3	4	5	6	7 Much more spectacular	8 Not sure

How satisfied were you with the overall look of the glacier?

1 Very dissatisfied ☹	2	3	4	5	6	7 Very satisfied ☺

Q.9 (b) Your perspective on images of the glacier (only to be answered if you have seen a glacier on your visit so far)

In the images that you saw before your visit, how accurate was the portrayal of the current condition of the glacier?

1 Not accurate at all	2	3	4	5	6	7 Very accurate

Q. 10 (a&b) Possible reasons for your visit to Aoraki/Mount Cook National Park

- **Forecast weather conditions**
- **Being with friends and/or family**
- **Being close to nature**
- **Experiencing an uncrowded setting**
- **Being in a challenging environment**
- **Experiencing a sense of discovery**
- **Having a story to tell**
- **Experiencing places I have read about**
- **Witnessing a glacier in real-life**
- **Seeing a glacial lake**
- **Getting close to a glacier**
- **Learning about the impacts of climate change on glaciers**

How important were each of the above factors in your decision to visit Aoraki/Mount Cook National Park?

1 Not important at all	2	3	4	5	6	7 Very important

How satisfied were you with each of the above factors in terms of their impact on your visit?

1 Very dissatisfied ☹	2	3	4	5	6	7 Very satisfied ☺

Q. 15 The importance of seeing a glacier in your decision to visit

How important was seeing a glacier in your decision to visit Aoraki/Mount Cook National Park?

1 Not important at all	2	3	4	5	6	7 Very important

Q. 16 (a-d) Your perspective on climate change and its impacts

- **Climate change is occurring right now**
- **Climate change is a result of natural causes**
- **Climate change is a result of human activity**
- **Climate change is very concerning**

To what extent do you agree or disagree with each of the above statements?

1 Completely disagree	2	3	4	5	6	7 Completely agree

Q. 18, 19, 20, 21 Your perspective on potential glacier-related scenarios

- **Seeing a glacier by plane**
- **Seeing a glacier by boat**
- **Not seeing a glacier at all**
- **Going elsewhere to see a glacier**

How willing would you be to visit Aoraki/Mount Cook National Park if each of the above scenarios were to become reality?

1 Not willing at all	2	3	4	5	6	7 Very willing

Appendix C

Online survey card

Appendix D

Survey screening device for commercial tourists

Appendix E

Survey research information sheet

Implications of climate change for glacier recreation and tourism at Aoraki/Mount Cook National Park

Information for prospective survey participants

What are the aims of the study?

The principal aims of this study are to investigate the implications of climate change for glacier recreation and tourism at Aoraki/Mount Cook National Park and explore the ways in which identified stakeholders perceive and interpret change in the Park.

What will you need to do?

Your participation will involve completing a brief survey which will be administered by the lead researcher. The survey is not expected to take more than 10 minutes to complete and will ask you various questions about your experiences at Aoraki/Mount Cook National Park.

What rights do you have as a participant?

You have a number of rights as a volunteer in this study, and we take these very seriously. These are described below:

- All information you give us will be anonymous and confidential. You will be provided with your own identification number, which will be used in place of your name on any information you give us. Any numeric information we use will be grouped so that individuals cannot be identified in oral or written presentations.
- No one but the lead researcher (Jessica Hughes Hutton) and the research supervisors (Emma Stewart and Stephen Espiner) will have access to your information.
- Participation is completely voluntary. You can choose not to answer any, some, or all questions. You can withdraw from the study at any time during the survey without explanation. If you complete the survey, however, it will be understood that you have consented to participation in the study and agree to publication of the results with the understanding that anonymity will be maintained.

What if you have any questions?

If you have any queries or concerns about your participation in the study, please contact me (Jessica Hughes Hutton) or my supervisors. We would be happy to discuss any concerns that you have about your contribution to this study.

Researcher: Jessica Hughes Hutton, Master of Applied Science, Lincoln University
Jessica.HughesHutton@lincolnuni.ac.nz
Ph. +64 27 320 0760

Supervisor: Emma Stewart PhD, Senior Lecturer in Parks & Tourism, Lincoln University
Emma.Stewart@lincoln.ac.nz
Ph. +64 3 423 0500

Supervisor: Stephen Espiner PhD, Senior Lecturer in Parks, Recreation & Tourism, Lincoln University
Stephen.Espiner@lincoln.ac.nz
Ph. +64 3 423 0485

This study has been reviewed and approved by the Lincoln University Human Ethics Committee.

Appendix F

Interview schedule

OPERATION / MANAGERIAL / RECREATIONAL BACKGROUND

- Role (what activities do you undertake in the Park / what service is your operation providing / what position do you hold?)

- Location (where do your activities take place / where in the Park is your operation located / where is your role based?)

- History (how long have you been utilising the Park for your activities / how long has your operation been running / how long have you been in your role?)

AORAKI/MOUNT COOK NATIONAL PARK

- How important is Aoraki/Mount Cook National Park to you personally? Has this changed over time?

- How important is the alpine environment of the Park to you / your operation?

- How important is tourism and/or recreation at the Park? How has the nature of tourism and recreation changed over the time you have been associated with the area?

VISITOR EXPERIENCE

- Why do you think the Park attracts so many visitors? What are the most important characteristics of the Park as a visitor attraction?

- What do you think are the main motives/expectations for visitors to the Park? Do you think these have changed over time?

- In your experience, how are visitors experiencing the alpine environment of the Park? Do you think their expectations of the Park are being met? Do you think they are satisfied with their experience of the Park?

GLACIERS

- What role do glaciers play in the Park? What role (if any) do glaciers play in your backcountry activities / your role at the Park / the running of your operation?

- In your experience, do visitors focus on / talk about / show interest in the glaciers? What do you think visitors like about the glaciers?

- How much do you rely on glaciers for the success of your business / role / lifestyle?

- What do you think will happen to the glaciers in the Park over the next 20 years? In what ways might this affect what you would like to do in the Park?

CLIMATE CHANGE / TOURISM & RECREATION

- In your experience, how has tourism and recreation changed / are changing in the Park? What has prompted these changes?

- In your experience, how has the physical landscape of the Park changed over time?

- Do you think the Park has been affected in any way by the changing climate?

- What are the implications of environmental change for you / your role / your operation / the visitor experience / the Park in general?

- Do you think visitors to the Park are aware of climate-related issues in the Park?

- Have you / has your operation needed to adapt to the changing environment? If so, how?

PARK FUTURE

- What adaptive strategies do you expect to adopt as you move into the foreseeable future?

- What do you think lies ahead for the Park? What are the challenges? Are you concerned?

- Do you think visitors will still come to the Park if the alpine environment continues to change?

- What does the future hold for glacier-related recreation and tourism in the Park? What are the implications for future planning?

Appendix G

Interview research information sheet

Implications of climate change for glacier recreation and tourism at Aoraki/Mount Cook National Park

Information for prospective interview participants

What are the aims of the study?

The principal aims of this study are to investigate the implications of climate change for glacier recreation and tourism at Aoraki/Mount Cook National Park and explore the ways in which identified stakeholders perceive and interpret change in the Park.

What will you need to do?

Your participation will involve a face-to-face interview which will be administered by the lead researcher. The interview is expected to take approximately 60 minutes to complete and will ask you various questions about your affiliation with Aoraki/Mount Cook National Park; your perspectives on the relationship between glacier-related climate change and visitor experience; strategies you have adopted to deal with environmental change and implications for the future of recreation and tourism in the Park.

What rights do you have as a participant?

You have a number of rights as a volunteer in this study, and we take these very seriously. These are described below:

- All information you give us will be anonymous and confidential. You will be provided with your own identification number, which will be used in place of your name throughout any written or oral presentations of this project.
- No one but the lead researcher (Jessica Hughes Hutton) and the research supervisors (Emma Stewart and Stephen Espiner) will have access to your information.
- Participation is completely voluntary. You can choose not to answer any, some, or all questions. You can withdraw from the study at any time **before June 30, 2017** by contacting one of us (contact details are listed below).
- Interviews will be conducted at a time and place to suit you and will be digitally recorded. The interviews will transcribed in full and you will have the opportunity to review your own interview transcript if you wish. If you prefer not to be recorded we will take notes throughout the interview – these notes will also be available for review once they are written up.

What if you have any questions?

If you have any queries or concerns about your participation in the study, please contact me (Jessica Hughes Hutton) or my supervisors. We would be happy to discuss any concerns that you have about your contribution to this study.

Researcher: Jessica Hughes Hutton, Master of Applied Science, Lincoln University
Jessica.HughesHutton@lincolnuni.ac.nz
Ph. +64 27 320 0760

Supervisor: Emma Stewart PhD, Senior Lecturer in Parks & Tourism, Lincoln University
Emma.Stewart@lincoln.ac.nz
Ph. +64 3 423 0500

Supervisor: Stephen Espiner PhD, Senior Lecturer in Parks, Recreation & Tourism, Lincoln University
Stephen.Espiner@lincoln.ac.nz
Ph. +64 3 4230485

This study has been reviewed and approved by the Lincoln University Human Ethics Committee.

Appendix H

Interview consent form

Participant ID #:

Lincoln University
Faculty of Environment, Society and Design

Implications of climate change for glacier recreation and tourism at Aoraki/Mount Cook National Park

Consent form for interview participants

I have read and understood the description of the above-named project. On this basis I agree to participate in the project, and I consent to publication of the results of the project with the understanding that anonymity will be preserved. I understand also that I may withdraw from the project, including withdrawal of any information I have provided, up to the 30 June, 2017.

Additionally,
☐ I consent to having an **audio recording** made of my interview.
☐ I consent to having **notes taken** during the interview

Name: _____

Date: _____

Signed: _____

Appendix J

Lincoln University Human Ethics Approval

9 December 2016

Application No: 2016-61

Title: The implications of climate change for glacier recreation and tourism in Aoraki/Mount Cook National Park, New Zealand.

Applicant: J Hughes-Hutton

The Lincoln University Human Ethics Committee has reviewed the above noted application.
Thank you for your response to the questions which were forwarded to you on the Committee's behalf.

I am satisfied on the Committee's behalf that the issues of concern have been satisfactorily addressed. I am pleased to give final approval to your project.

Please note that this approval is valid for three years from today's date at which time you will need to reapply for renewal.

Once your field work has finished can you please advise the Human Ethics Secretary, Alison Hind, and confirm that you have complied with the terms of the ethical approval.

May I, on behalf of the Committee, wish you success in your research.

Yours sincerely

Grant Tavinor
Chair, Human Ethics Committee

PLEASE NOTE: The Human Ethics Committee has an audit process in place for applications. Please see 7.3 of the Human Ethics Committee Operating Procedures (ACHE) in the Lincoln University Policies and Procedures Manual for more information.

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